CALIFORNIA

STATE LIBRARY.

Accession No. 136401

Call No. C528 T29

0 2007 1248612 1
California State Library

Th
A b
for

PRICE, ONE DOLLAR.

TENNENT'S

Nautical Almanac

TIDE REGISTER

FOR

THE PACIFIC COAST,

AND

MARINE DIGEST

FOR

CALIFORNIA

1879.

STATE LIBRARY

By THOMAS TENNENT,

CHRONOMETER, WATCH AND NAUTICAL INSTRUMENT MAKER.

DEPOT FOR U. S. GOVERNMENT CHRONOMETERS,

SAN FRANCISCO.

PAYOT, UPHAM & CO., PUBLISHERS,

204 SANSOME STREET.

PACIFIC
MAIL STEAMSHIP CO.

The Steamships of this Company will sail
From SAN FRANCISCO, during the year 1879, as follows:

FROM WHARF, COR. FIRST AND BRANNAN STS.

Hour of Departure, 12, Noon.

FOR YOKOHAMA AND HONGKONG,

On the 1st of every month, Connecting at Yokohama with the Steamers of the MITSU BISHI Co., for

HIOGO, NAGASAKI and SHANGHAI.

FOR SYDNEY & AUCKLAND, VIA HONOLULU

January 20th, 1879, and every Fourth Monday thereafter. Through Bills of Lading issued for Melbourne, Adelaide and Brisbane, and principal New Zealand Ports.

FOR NEW YORK AND PANAMA,

On the 5th and 20th of Every Month, taking Passengers and Freight for Mexican, Central American and South American Ports; for Liverpool, London and Southampton; for St. Nazaire, and for Hamburg, Bremen and Antwerp.

FOR VICTORIA, B. C., PORT TOWNSEND, SEATTLE, TACOMA, OLYMPIA AND PORTLAND,

On the 10th, 20th and 30th of Every Month.

WILLIAMS, BLANCHARD & CO., Agents.

SAN FRANCISCO, January 1, 1879.

TENNENT'S

Nautical Almanac

TIDE REGISTER

FOR

THE PACIFIC COAST,

AND

MARINE DIGEST

FOR

1879.

By THOMAS TENNENT,

CHRONOMETER, WATCH AND NAUTICAL INSTRUMENT MAKER.

DEPOT FOR U. S. GOVERNMENT CHRONOMETERS,

SAN FRANCISCO.

Entered according to Act of Congress, in the year eighteen hundred and seventy-nine,

By THOMAS TENNENT,

In the Office of the Librarian of Congress at Washington.

CALIFORNIA
STATE LIBRARY

BACON & COMPANY,

Printers,

Corner Clay and Sansome Streets.

FIFTEENTH YEAR OF PUBLICATION.

This work was first issued in 1864, in an edition of two hundred copies, simply as a Tide Table for the Port of San Francisco. Meeting with rapid sale, the book has been enlarged each succeeding year, and its circulation has so increased that it now requires an edition of fifteen hundred copies to meet the demand. It contains the time of the two high waters for each day in the year, for the ports of San Francisco, San Diego, Astoria, and Port Townsend, together with Tables of Tidal Constants, by means of which the time of high water can be found for each day at fifty-six other points in San Francisco Bay and on the coast between San Diego and Puget Sound. These Tide Tables are from data derived from eight years' additional records of the various Tide Guages specially furnished to me by the United States Coast Survey Office at Washington, D. C., and will be found correct, the critical test applied by so many navigators during the past fourteen years having proved their accuracy and reliability.

The book also contains full and complete Sailing Directions for approaching and entering the harbor of San Francisco; all the Harbor Laws and Sanitary Regulations; the Sun's Right Ascension, Declination, and Equation of Time, with hourly differences; a complete list of all the Light-houses now erected on the coast; all the Fog Signals now in operation; notices of all newly discovered rocks and dangers on the coast and in the Pacific Ocean generally; together with new and selected extracts, examples in working time, and many other matters of interest to the navigator, which are more fully set forth in the Table of Contents on the next page.

The Table of Rainfall in this city, arranged in months and seasons, giving the quantity of rain and the number of rainy days from the season of 1849–50 to that of 1877–78 inclusive, is from records kept by me during that period, and although somewhat foreign to the character of this work, yet, never having before been published continuously, will be of interest to many, especially to those interested in our grain crops.

In the present edition I have inserted the Act of Congress in relation to coloring, numbering, and placing of Beacons, Buoys, &c., together with the location of all Buoys indicating the approaches to San Francisco Bay, and also those placed within this Bay, San Pablo and Suisun Bays, up to the entrance of Sacramento River, for the guidance of bay and river crafts, corrected up to date; also, an important Rule and Table, by means of which the time of low water can be readily found for any day in the year, and for any point on the coast; also, a Table showing for every tenth day in the year, in San Francisco mean time, the Upper and Lower Meridian Passages, and also the greatest Eastern and Western Elongations of the Pole Star. This will be of great serviee to navigators in observing for latitude or azimuth, and also to surveyors and engineers in finding the variations of the compass.

Succeeding editions will be enlarged as may be required, and no pains will be spared to make the work, as heretofore, indispensable to shipmasters employed on this coast, and very convenient to all others.

THOMAS TENNENT.

136401

TABLE OF CONTENTS.

Eclipses in 1879.
Morning and Evening Stars.
Sun Rising and Setting at San Francisco.
Moon Rising and Setting at San Francisco.
The Sun's Right Ascension, with Hourly Difference.
The Sun's Declination at Apparent Noon, Greenwich ; with Hourly Difference.
The Equation of Time, Greenwich ; with Hourly Difference.
High Water at San Francisco, California.
High Water at San Diego, California.
High Water at Astoria, Oregon.
High Water at Port Townsend, Washington Territory.
Table of Tidal Constants for Ports between San Diego and Sitka.
Tides at Sitka.
Rule and Table to find the Time of Low Water at all points on the Coast.
Fog Signals on the Coasts of California, Oregon, and Washington Territory.
Light-Houses and Important Headlands on West Coast United States.
Description of Light-House Buildings on West Coast United States.
Table of Distances from San Francisco to Panama.
Table of Distances from San Francisco to Sitka.
Moon's Phases at San Francisco (mean time).
Newly discovered dangers off the West Coast of North America.
Rocks and Shoals in the North Pacific Ocean, new reports.
Rocks and Shoals in the South Pacific Ocean, " "
Sailing Directions for approaching and entering San Francisco Harbor.
Act of Congress in relation to Coloring Numbering, and Placing Buoys, Beacons, Spindles, &c.
Buoys and Beacons indicating the Approaches to San Francisco Bay, with Directions for Entering.
Buoys and Beacons in San Francisco, San Pablo and Suisun Bays, for the use of bay and river crafts.
Shipping Commissioner, Act of Congress creating the Office.
Pilot Laws, San Francisco Harbor.
Harbor Regulations, San Francisco Harbor.
Rates of Dockage, Wharfage and Tolls, San Francisco.
Port Warden's Duties, San Francisco Harbor.
Harbor Police Regulations, San Francisco Harbor.
Quarantine Regulations, San Francisco Harbor.
Telegraph Cable in San Francisco Bay, and penalties for damaging.
Passenger Act of State of California, Duty of Shipmasters in relation thereto.
Act of Congress to prevent Collisions at Sea.
Act of Congress in relation to Lights and Fog Signals.
Hurricanes (compiled).
Hurricanes, Rules to avoid them (new).
Thermometer, its use on approaching Ice or Land.
Barometer and Barometric Indications.
The Aneroid Barometer.
The Chronometer, General Instructions.
The Pole Star ; its meridian passages and elongations for every tenth day in San Francisco mean time.
To find the Latitude by the Pole Star, with examples.
The Greenwich Date, Method of Finding, with examples.
The Sun's Declination, to find and correct for any meridian, with examples from this Nautical Almanac.
The Equation of Time, to find and correct for any meridion, with examples, from this Nautical Almanac.
Longitude at Noon from Equal Altitudes of the Sun, by Chronometer, with examples.
Longitude and Apparent Time at Sunrise and Sunset, by Chronometer, with examples.
Gain or Loss of Time in Circumnavigating the Globe, East or West, with examples.
Rain-fall at San Francisco, arranged in seasons from 1849 to 1878.

ECLIPSES IN 1879.

In the year 1879 there will be two Eclipses of the Sun and one of the Moon.

I. An Annular Eclipse of the Sun, January 21-22. Invisible at San Francisco.
Begins on the Earth, generally, January 21, 20 hours 59.5 min. mean time at Greenwich, in longitude 51 deg. 3 min. West of Greenwich, and latitude 24 deg. 0 min. South.
Central Eclipse at Noon, January 21, 23 hours 45.9 min. in longitude 6 deg. 28 min. East of Greenwich, and latitude 31 deg. 0 min. South.
Ends on the Earth, generally, January 22, 2 hours 46.2 min. in longitude 47 deg. 18 min. East of Greenwich, and latitude 11 deg. 20 min. North.

II. An Annular Eclipse of the Sun, July 18. Invisible at San Francisco.
Begins on the Earth, generally, July 18th, 18 hours 10.7 min. mean time at Greenwich, in longitude 5 deg. 13 min. West of Greenwich, and latitude 10 deg. 32 min. North.
Central Eclipse at Noon, July 18, 21 hours 9.2 min., in longitude 44 deg. 13 min. East of Greenwich, and latitude 12 deg. 18 min. North.
Ends on the Earth, generally, July 18, 23 hours 58 min., in longitude 83 deg. 50 min. East of Greenwich, and latitude 20 deg. 31 min. South.

III. A partial Eclipse of the Moon, December 28. Invisible at San Francisco, the first contact occurring at sunrise.

Movable Anniversaries.

Ash Wednesday .....February 26	Easter Sunday .....April 13
First Sunday in Lent.....March 2	Ascension Day .....May 22
Palm Sunday .....April 6	Pentecost ....June 1
Good Friday .....April 11	First Sunday in Advent....November 30

Morning and Evening Stars.

Venus will be Evening Star to September 20, then Morning Star the rest of the year.
Mars will be Morning Star to July 17, then Evening Star the rest of the year.
Jupiter will be Evening Star to February 13, then Morning Star the rest of the year.
Saturn will be Evening Star to March 28, then Morning Star to July 7, then Evening Star the rest of the year.

JANUARY, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Small.	Large.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	P.M.	A.M.
Wed....	1	6 06	6 56	4 38	4 23	6 36	7 18	11 55	9 47
Thur....	2	6 47	8 04	5 11	6 17	7 30	8 20	A.M.	10 21
Frid....	3	7 43	9 16	5 50	7 48	8 22	9 24	1 18	10 56
Sat.....	4	8 25	10 19	6 32	8 51	9 11	10 33	2 39	11 35
Sun.....	5	9 06	11 18	7 14	9 42	9 58	11 39	3 53	P.M.
Mon....	6	9 51	A.M.	7 55	10 14	10 44	A.M.	large	small
Tues....	7	10 35	0 10	8 31	10 40	11 34	0 31	5 31	1 44
Wed	8	11 19	0 52	9 09	11 11	P.M.	1 19	6 01	2 24
Thur....	9	P.M.	1 32	9 48	11 47	1 10	1 58	6 32	3 08
Frid....	10	0 42	2 07	10 29	A.M.	1 53	2 34	6 58	4 06
Sat.....	11	1 29	2 36	11 10	0 25	2 35	3 04	7 14	5 19
Sun.....	12	small	large	11 51	1 03	small	large	7 33	6 40
Mon....	13	3 40	3 34	P.M.	1 46	4 18	4 08	7 49	8 04
Tues....	14	4 57	4 16	small	large	5 22	4 47	8 20	9 37
Wed....	15	6 14	5 05	3 20	3 24	6 33	5 38	8 57	11 10
Thur....	16	7 36	6 03	5 11	4 13	7 49	6 37	9 37	A.M.
Frid....	17	8 56	7 05	6 50	5 07	9 08	7 35	10 21	0 46
Sat.....	18	10 16	8 01	8 14	6 08	10 27	8 45	11 05	2 19
Sun.....	19	11 30	8 56	9 18	7 10	11 41	9 50	small	large
Mon....	20	A.M.	9 49	10 02	7 58	A.M.	10 48	P.M.	4 48
Tues....	21	0 19	10 35	10 35	8 35	0 37	11 40	1 33	5 34
Wed....	22	0 57	11 23	10 58	9 02	1 24	P.M.	2 33	6 04
Thur	23	1 27	P.M.	11 33	9 40	2 01	1 10	3 36	6 25
Frid....	24	1 50	0 40	A.M.	10 13	2 29	1 49	4 40	6 45
Sat.....	25	large	small	0 02	10 46	large	small	5 41	6 52
Sun.....	26	2 34	2 13	0 35	11 12	3 14	3 08	6 42	6 59
Mon....	27	2 58	3 09	large	small	3 40	3 57	7 45	7 10
Tues....	28	3 27	4 15	1 49	P.M.	4 10	4 49	8 55	7 29
Wed....	29	4 06	5 22	2 32	2 12	4 41	5 44	10 14	7 56
Thur	30	4 55	6 34	3 25	3 47	5 29	6 42	11 43	8 29
Frid....	31	5 47	7 42	4 12	5 50	6 23	7 47	A.M.	9 06

Monthly Mean of Sun's Semi-diameter, 16 17.4.

JANUARY, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *added* to Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	H. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	7 21	4 47	0 47	18 46 50	11.0	S. 23 1 11	12.3	3 45.3	1.18
2	7 21	4 47	1 44	18 51 14	11.0	22 56 1	13.5	4 13.5	1.17
3	7 21	4 48	2 42	18 55 39	11.0	22 50 23	14.6	4 41.3	1.15
4	7 21	4 49	3 42	19 0 3	11.0	22 44 18	15.8	5 8.7	1.13
5	7 21	4 50	4 39	19 4 27	11.0	22 37 46	16.9	5 35.8	1.12
6	7 21	4 51	5 37	19 8 50	11.0	22 30 48	18.0	6 2.3	1.10
7	7 21	4 52	rises	19 13 13	10.9	22 23 22	19.1	6 28.4	1.08
8	7 21	4 53	5 44	19 17 35	10.9	22 15 31	20.2	6 54.0	1.05
9	7 21	4 54	6 54	19 21 56	10.9	22 7 13	21.3	7 19.0	1.03
10	7 21	4 55	8 04	19 26 18	10.9	21 58 29	22.4	7 43.6	1.01
11	7 20	4 56	9 13	19 30 38	10.8	21 49 20	23.4	8 7.5	0.99
12	7 20	4 57	10 21	19 34 58	10.8	21 39 45	24.5	8 30.9	0.96
13	7 20	4 58	11 30	19 39 18	10.8	21 29 44	25.5	8 53.6	0.94
14	7 20	4 59	morn	19 43 36	10.8	21 19 19	26.6	9 15.8	0.91
15	7 19	5 00	0 40	19 47 54	10.7	21 8 29	27.6	9 37.3	0.88
16	7 19	5 01	1 51	19 52 12	10.7	20 57 15	28.6	9 58.2	0.85
17	7 19	5 01	3 01	19 56 29	10.7	20 45 37	29.6	10 18.4	0.83
18	7 18	5 02	4 08	20 0 45	10.7	20 33 34	30.6	10 37.9	0.80
19	7 18	5 03	5 10	20 5 0	10.6	20 21 9	31.5	10 56.7	0.77
20	7 17	5 04	6 05	20 9 15	10.6	20 8 20	32.5	11 14.7	0.74
21	7 17	5 05	sets	20 13 29	10.6	19 55 9	33.4	11 32.0	0.71
22	7 16	5 06	5 29	20 17 42	10.5	19 41 36	34 3	11 48.6	0.67
23	7 16	5 08	6 35	20 21 54	10.5	19 27 40	35.3	12 4.4	0.64
24	7 15	5 09	7 39	20 26 6	10.5	19 13 23	36.1	12 19.4	0.61
25	7 15	5 11	8 38	20 30 17	10.4	18 58 45	37.0	12 33.6	0.57
26	7 14	5 11	9 37	20 34 27	10.4	18 43 46	37.9	12 46.9	0.54
27	7 14	5 12	10 34	20 38 36	10.4	18 28 27	38.7	12 59.5	0.50
28	7 13	5 13	11 31	20 42 44	10.3	18 12 48	39.5	13 11.2	0.47
29	7 12	5 14	morn	20 46 52	10.3	17 56 49	40.3	13 22.1	0.44
30	7 11	5 15	0 30	20 50 58	10.3	17 40 31	41.1	13 32.1	0.40
31	7 10	5 17	1 29	20 55 4	10.2	17 23 54	41.9	13 41.3	0.37

M. S.

Sun's Semi-diameter passing the Meridian, 1 9.7

FEBRUARY, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	A.M.
Sat.....	1	6 44	8 54	5 01	7 11	7 25	8 56	1 13	9 48
Sun.....	2	7 40	10 02	5 56	8 12	8 27	10 05	2 34	10 31
Mon.....	3	8 34	11 02	6 47	8 56	9 27	11 12	3 33	11 19
Tues....	4	9 24	11 52	7 28	9 28	10 21	A.M.	4 15	P.M.
Wed	5	10 15	A.M.	8 13	9 55	11 16	0 11	4 48	1 13
Thur....	6	11 02	0 34	8 57	10 24	P.M.	0 57	5 14	2 23
Frid.....	7	11 48	1 03	9 38	10 58	0 57	1 37	5 41	3 37
Sat.....	8	small	large	10 17	11 30	1 43	2 07	6 06	4 50
Sun.....	9	P.M.	1 50	11 05	11 57	small	large	6 19	6 01
Mon.....	10	2 23	2 15	small	large	3 14	2 58	6 32	7 10
Tues....	11	3 36	2 45	P.M.	A.M.	4 08	3 27	6 45	8 23
Wed	12	4 57	3 29	2 03	1 28	5 13	4 08	7 10	9 51
Thur....	13	6 22	4 24	4 05	2 27	6 26	5 03	7 50	11 32
Frid	14	7 44	5 28	6 03	3 34	7 49	6 09	8 37	A.M.
Sat	15	9 04	6 34	7 30	4 41	9 11	7 19	9 30	1 12
Sun	16	10 15	7 42	8 28	5 52	10 27	8 28	small	large
Mon. ...	17	11 10	8 45	9 15	7 00	11 28	9 34	11 32	3 31
Tues....	18	11 52	9 41	9 45	7 53	A.M.	10 35	P.M.	4 11
Wed....	19	A.M.	10 31	10 04	8 35	0 16	11 29	1 44	4 41
Thur....	20	0 20	11 13	10 23	9 06	0 53	P.M.	2 49	5 02
Frid....	21	0 44	11 52	10 42	9 35	1 21	0 56	3 52	5 18
Sat.....	22	large	small	11 01	10 00	large	small	4 53	5 28
Sun.....	23	1 21	P.M.	11 19	10 25	2 09	2 07	5 53	5 38
Mon.....	24	1 39	1 47	11 36	10 53	2 31	2 45	6 56	5 43
Tues....	25	2 03	2 47	large	small	2 51	3 27	8 01	5 57
Wed	26	2 35	3 54	A.M.	P.M.	3 20	4 15	9 06	6 13
Thur....	27	3 15	4 58	0 40	1 55	3 57	5 12	10 16	6 39
Frid	28	4 03	6 06	1 25	3 23	4 45	6 14	11 24	7 10

Monthly Mean of Sun's Semi-diameter, 16′ 13.3″

FEBRUARY, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *added* to Apparent Time.	Diff. for One Hour.
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	7 09	5 19	2 26	20 59 9	10.2	S. 17 6 59	42.7	13 49.7	0.33
2	7 09	5 19	3 24	21 3 13	10.2	16 49 46	43.4	13 57.2	0.30
3	7 08	5 20	4 19	21 7 16	10.1	16 32 16	44.1	14 3.9	0.26
4	7 07	5 21	5 09	21 11 19	10.1	16 14 28	44.8	14 9.8	0.23
5	7 06	5 22	5 53	21 15 20	10.1	15 56 24	45.5	14 14.8	0.19
6	7 05	5 23	rises	21 19 21	10.0	15 38 3	46.2	14 19.1	0.16
7	7 04	5 24	6 57	21 23 21	10.0	15 19 27	46.8	14 22.5	0.12
8	7 02	5 26	8 08	21 27 20	9.9	15 0 35	47.5	14 25.1	0.09
9	7 01	5 27	9 18	21 31 19	9.9	14 41 28	48.1	14 26.9	0.06
10	7 00	5 28	10 30	21 35 16	9.9	14 22 5	48.7	14 27.9	0.03
11	6 59	5 29	11 41	21 39 13	9.8	14 2 29	49.3	14 28.2	0.00
12	6 58	5 30	morn	21 43 9	9.8	13 42 38	49.9	14 27.7	0.03
13	6 57	5 31	0 52	21 47 4	9.8	13 22 34	50.4	14 26.5	0.07
14	6 56	5 32	2 01	21 50 59	9.8	13 2 17	51.0	14 24.6	0.10
15	6 55	5 33	3 05	21 54 53	9.7	12 41 47	51.5	14 21.9	0.12
16	6 54	5 34	4 01	21 58 46	9.7	12 21 4	52.0	14 18.6	0.15
17	6 52	5 36	4 47	22 2 39	9.7	12 0 10	52.5	14 14.5	0.18
18	6 51	5 37	5 28	22 6 30	9.6	11 39 4	53.0	14 9.8	0.21
19	6 50	5 38	6 01	22 10 22	9.6	11 17 47	53.4	14 4.3	0.24
20	6 49	5 39	sets	22 14 12	9.6	10 56 19	53.9	13 58.2	0.27
21	6 48	5 40	6 25	22 18 2	9.6	10 34 42	54.3	13 51.4	0.30
22	6 47	5 41	7 23	22 21 51	9.5	10 12 54	54.7	13 44.0	0.32
23	6 46	5 42	8 24	22 25 39	9.5	9 50 58	55.0	13 36.0	0.35
24	6 44	5 43	9 20	22 29 27	9.5	9 28 52	55.4	13 27.3	0.37
25	6 42	5 45	10 18	22 33 14	9.5	9 6 38	55.7	13 18.0	0.40
26	6 41	5 46	11 17	22 37 1	9.4	8 44 16	56.1	13 8.1	0.42
27	6 40	5 48	morn	22 40 47	9.4	8 21 46	56.4	12 57.7	0.45
28	6 38	5 48	0 15	22 44 33	9.4	7 59 9	56.7	12 46.7	0.47

M. S.

Sun's Semi-diameter passing the Meridian, 1 6.6.

MARCH, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		A.M.
Sat. . .	1	4 59	7 18	2 30	5 15	5 38	7 17	A.M.	7 49
Sun.	2	6 00	8 29	3 55	6 51	6 37	8 27	0 33	8 38
Mon	3	7 04	9 29	5 21	7 58	7 41	9 33	1 41	9 41
Tues	4	8 03	10 27	6 30	8 30	8 49	10 39	2 39	10 57
Wed. . . .	5	9 03	11 12	7 15	8 49	9 55	11 36	3 24	P.M.
Thur. . . .	6	9 59	11 44	8 00	9 12	10 58	A.M.	3 55	1 30
Frid	7	10 50	A.M.	8 34	9 35	11 53	0 22	4 21	2 43
Sat.	8	small	large	9 16	9 59	P.M.	0 59	4 40	3 55
Sun. . .	9	P.M.	0 40	10 03	10 23	small	large	4 55	5 08
Mon	10	1 26	1 06	small	large	2 20	2 00	5 16	6 24
Tues	11	2 32	1 32	11 35	11 41	3 11	2 26	5 29	7 42
Wed. . . .	12	3 43	2 08	P.M.	A.M.	4 04	2 56	5 48	9 04
Thur. . . .	13	5 09	2 59	2 35	0 25	5 07	3 42	6 14	10 25
Frid	14	6 31	4 00	4 51	1 32	6 19	4 40	small	large
Sat.	15	7 48	5 07	6 48	3 05	7 39	5 45	7 43	A.M.
Sun.	16	8 52	6 17	7 37	4 46	8 57	6 58	9 01	0 55
Mon	17	9 48	7 20	8 12	6 09	10 05	8 07	10 23	1 55
Tues	18	10 35	8 23	8 31	7 00	10 59	9 15	11 42	2 44
Wed. . . .	19	11 09	9 22	8 45	7 44	11 40	10 16	P.M.	3 21
Thur. . . .	20	large	small	9 04	8 25	A.M.	11 13	2 08	3 49
Frid	21	11 54	11 04	9 29	8 51	0 12	P.M.	3 13	4 08
Sat.	22	A.M.	11 43	9 45	9 19	large	small	4 11	4 17
Sun . . .	23	0 11	P.M.	large	small	1 01	1 20	5 07	4 27
Mon	24	0 30	0 56	10 16	10 18	1 25	1 54	6 07	4 33
Tues . . .	25	0 53	1 42	10 39	10 52	1 48	2 33	7 07	4 46
Wed. . . .	26	1 18	2 38	11 03	11 33	2 14	3 15	8 10	4 59
Thur. . . .	27	1 47	3 41	11 28	P.M.	2 44	4 00	9 14	5 16
Frid	28	2 23	4 42	A.M.	2 03	3 17	4 51	10 14	5 43
Sat	29	3 13	5 46	0 21	3 50	3 30	5 45	large	small
Sun.	30	4 16	6 51	1 38	5 33	4 48	6 47	11 53	7 05
Mon	31	5 22	7 54	3 29	6 25	5 59	7 48	A.M.	8 04

Monthly Mean of Sun's Semi-diameter, 16′ 6″.

MARCH, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *added* to Apparent Time.	Diff. for One Hour.
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	6 37	5 48	1 12	22 48 18	9.4	S. 7 36 25	57.0	12 35.1	0.49
2	6 36	5 49	2 07	22 52 2	9.3	7 13 35	57.2	12 23.0	0.51
3	6 34	5 50	2 58	22 55 46	9.3	6 50 39	57.5	12 10.4	0.53
4	6 33	5 51	3 44	22 59 29	9.3	6 27 37	57.7	11 57.4	0.55
5	6 31	5 52	4 25	23 3 12	9.3	6 4 30	57.9	11 43.8	0.57
6	6 30	5 53	5 00	23 6 55	9.3	5 41 18	58.0	11 29.8	0.59
7	6 28	5 54	rises	23 10 37	9.2	5 18 2	58.3	11 15.4	0.61
8	6 27	5 55	6 58	23 14 19	9.2	4 54 41	58.4	11 0.6	0.63
9	6 26	5 57	8 11	23 18 0	9.2	4 31 17	58.6	10 45.4	0.64
10	6 24	5 58	9 25	23 21 41	9.2	4 7 49	58.7	10 29.8	0.65
11	6 23	5 59	10 39	23 25 22	9.2	3 44 18	58.8	10 13.9	0.67
12	6 21	6 00	11 50	23 29 2	9.2	3 20 44	59.0	9 57.7	0.68
13	6 19	6 01	morn	23 32 42	9.2	2 57 7	59.1	9 41.3	0.69
14	6 17	6 02	0 57	23 36 22	9.2	2 33 29	59.1	9 24.5	0.70
15	6 15	6 03	1 57	23 40 1	9.1	2 9 49	59.2	9 7.6	0.71
16	6 14	6 03	2 47	23 43 41	9.1	1 46 7	59.2	8 50.4	0.72
17	6 13	6 04	3 29	23 47 20	9.1	1 22 25	59.3	8 33.0	0.73
18	6 11	6 05	4 03	23 50 59	9.1	0 58 42	59.3	8 15.5	0.73
19	6 10	6 06	4 32	23 54 37	9.1	0 34 59	59.3	7 57.7	0.74
20	6 08	6 06	4 59	23 58 16	9.1	S. 0 11 16	59.3	7 39.9	0.75
21	6 07	6 07	sets	0 1 55	9.1	N. 0 12 26	59.2	7 21.9	0.75
22	6 05	6 09	6 16	0 5 33	9.1	0 36 8	59.2	7 3.8	0.76
23	6 04	6 10	7 12	0 9 11	9.1	0 59 48	59.1	6 45.6	0.76
24	6 03	6 11	8 09	0 12 50	9.1	1 23 26	59.0	6 27.3	0.76
25	6 01	6 11	9 07	0 16 28	9.1	1 47 2	58.9	6 9.0	0.76
26	6 00	6 12	10 06	0 20 6	9.1	2 10 35	58.8	5 50.6	0.77
27	5 58	6 13	11 03	0 23 44	9.1	2 34 6	58.7	5 32.2	0.77
28	5 56	6 14	11 58	0 27 22	9.1	2 57 33	58.6	5 13.8	0.77
29	5 55	6 15	morn	0 31 0	9.1	3 20 57	58.4	4 55.4	0.76
30	5 53	6 16	0 50	0 34 38	9.1	3 44 17	58.2	4 37.1	0.76
31	5 51	6 17	1 37	0 38 17	9.1	4 7 33	58.0	4 18.8	0.76

M. S.

Sun's Semi-diameter passing the Meridian, 1 4.6

APRIL, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	A.M.
Tues....	1	6 32	8 53	4 58	7 02	7 11	8 53	0 40	9 18
Wed....	2	7 36	9 42	5 59	7 39	8 18	9 54	1 26	10 41
Thur....	3	8 39	10 25	small	large	small	large	2 10	P.M.
Frid.....	4	small	large	7 46	8 41	10 35	11 40	2 54	1 45
Sat.....	5	10 37	11 23	8 30	9 03	11 36	A.M.	3 32	3 05
Sun.....	6	11 32	11 54	9 12	9 25	P.M.	0 14	3 56	4 22
Mon.....	7	P.M.	A.M.	9 51	9 44	1 25	0 46	3 59	5 39
Tues....	8	1 35	0 26	10 45	10 05	2 15	1 20	4 12	6 54
Wed	9	2 45	1 03	11 49	10 46	3 10	1 57	4 25	8 08
Thur....	10	3 55	1 46	P.M.	11 39	4 07	2 39	4 53	9 18
Frid.....	11	5 04	2 31	3 10	A.M.	5 07	3 24	small	large
Sat.....	12	6 12	3 25	4 38	0 43	6 13	4 19	6 24	11 19
Sun.....	13	7 17	4 37	6 02	2 07	7 17	5 26	7 34	A.M.
Mon.....	14	8 12	5 51	6 47	3 35	8 18	6 37	8 55	0 09
Tues....	15	9 00	6 59	7 18	5 04	9 15	7 44	10 19	0 52
Wed	16	9 41	7 59	large	small	large	small	11 41	1 30
Thur....	17	large	small	8 10	7 15	10 51	9 46	P.M.	2 05
Frid	18	10 40	9 48	8 25	8 01	11 22	10 45	2 21	2 33
Sat.....	19	11 01	10 36	8 38	8 33	11 51	11 38	3 30	2 51
Sun.....	20	11 24	11 25	8 53	9 07	A.M.	P.M.	4 36	3 09
Mon.....	21	11 45	P.M.	9 11	9 46	0 15	1 05	5 36	3 17
Tues....	22	A.M.	1 02	9 32	10 15	0 41	1 37	6 33	3 27
Wed....	23	0 14	1 49	9 55	10 52	1 12	2 15	7 28	3 38
Thur....	24	0 45	2 41	10 31	11 38	1 43	2 58	8 14	3 54
Frid....	25	1 21	3 33	11 13	P.M.	2 18	3 46	large	small
Sat.....	26	1 59	4 26	A.M.	2 51	2 54	4 34	9 36	4 46
Sun.....	27	2 47	5 18	0 11	4 12	3 38	5 26	10 15	5 26
Mon.....	28	3 43	6 06	1 34	5 08	4 30	6 17	10 55	6 26
Tues....	29	4 41	6 54	2 51	5 45	5 29	7 07	11 30	7 44
Wed....	30	5 45	7 40	4 12	6 18	6 34	7 56	A.M.	9 10

Monthly Mean of Sun's Semi-diameter, 15′ 58″.1

APRIL, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets,	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *added* to / *subtracted* from Apparent Time.	Diff. for One Hour.
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 49	6 18	2 19	0 41 55	9.1	N. 4 30 44	57.8	4 0.6	0.76
2	5 47	6 19	2 55	0 45 33	9.1	4 53 50	57.6	3 42.5	0.75
3	5 46	6 20	3 28	0 49 12	9.1	5 16 50	57.4	3 24.4	0.75
4	5 45	6 21	3 59	0 52 50	9.1	5 39 45	57.2	3 6.5	0.74
5	5 44	6 22	rises	0 56 29	9.1	6 2 34	56.9	2 48.8	0.74
6	5 43	6 22	6 58	1 0 8	9.1	6 25 17	56.6	2 31.2	0.73
7	5 42	6 23	8 14	1 3 47	9.1	6 47 53	56.4	2 13.8	0.72
8	5 40	6 24	9 30	1 7 26	9.1	7 10 22	56.1	1 56.7	0.71
9	5 39	6 25	10 41	1 11 6	9.2	7 32 44	55.8	1 39.7	0.70
10	5 37	6 27	11 46	1 14 46	9.2	7 54 59	55.4	1 23.1	0.69
11	5 36	6 27	morn	1 18 26	9.2	8 17 6	55.1	1 6.7	0.67
12	5 35	6 28	0 42	1 22 7	9.2	8 39 4	54.8	0 50.7	0.66
13	5 33	6 29	1 28	1 25 47	9.2	9 0 54	54.4	0 34.9	0.65
14	5 32	6 30	2 05	1 29 28	9.2	9 22 36	54 0	0 19.5	0.63
15	5 30	6 31	2 37	1 33 10	9.2	9 44 8	53.6	0 4.5	0.62
16	5 28	6 32	3 03	1 36 52	9.3	10 5 30	53.2	0 10.2	0.60
17	5 27	6 33	3 28	1 40 34	9.3	10 26 43	52.8	0 24.5	0.59
18	5 26	6 34	3 50	1 44 17	9.3	10 47 45	52.4	0 38.4	0.57
19	5 24	6 34	4 16	1 48 0	9.3	11 8 36	51.9	0 51.9	0.55
20	5 23	6 35	sets	1 51 43	9.3	11 29 17	51.5	1 5.0	0.54
21	5 22	6 36	7 01	1 55 27	9.3	11 49 46	51.0	1 17.7	0.52
22	5 21	6 37	7 59	1 59 11	9.4	12 10 4	50.5	1 29.9	0.50
23	5 20	6 38	8 56	2 2 56	9.4	12 30 10	50.0	1 41.7	0.48
24	5 18	6 39	9 52	2 6 41	9.4	12 50 3	49.5	1 53.0	0.46
25	5 16	6 40	10 44	2 10 27	9.4	13 9 44	48.9	2 3.8	0.44
26	5 15	6 41	11 33	2 14 13	9.4	13 29 11	48.4	2 14.2	0.42
27	5 14	6 42	morn	2 18 0	9.5	13 48 26	47.8	2 24.1	0.40
28	5 13	6 43	0 16	2 21 47	9.5	14 7 26	47.2	2 33.5	0.38
29	5 11	6 44	0 54	2 25 34	9.5	14 26 13	46.6	2 42.4	0.36
30	5 10	6 45	1 27	2 29 22	9.5	14 44 45	46.0	2 50.9	0.34

Sun's Semi-diameter passing the Meridian, M. S. 1 4.9

MAY, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Large.	Small.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	A.M.
Thur....	1	6 55	8 27	5 19	6 46	7 43	8 47	0 11	10 45
Frid.....	2	8 10	9 15	6 14	7 08	8 54	9 46	0 48	P.M.
Sat.....	3	9 27	10 05	7 03	7 33	10 11	10 45	1 25	1 55
Sun.....	4	10 37	10 49	8 00	8 02	11 26	11 34	2 03	3 26
Mon.....	5	11 45	11 18	8 57	8 35	P.M.	A.M.	2 38	4 54
Tues....	6	P.M.	11 45	9 59	9 14	1 23	0 12	3 02	6 28
Wed....	7	1 43	A.M.	11 02	9 48	2 12	0 52	3 18	7 26
Thur....	8	2 45	0 24	P.M.	10 37	3 06	1 33	small	large
Frid.....	9	3 45	1 11	1 31	11 16	4 01	2 18	4 13	8 57
Sat.....	10	4 44	2 13	2 55	A.M.	4 57	3 06	4 55	9 35
Sun.....	11	5 39	3 19	4 13	0 41	5 52	4 04	5 52	10 20
Mon.....	12	6 29	4 22	5 11	1 52	6 42	5 04	7 12	11 03
Tues....	13	large	small	large	small	7 30	6 08	8 50	11 43
Wed....	14	8 02	6 31	6 16	4 21	large	small	10 28	A.M.
Thur....	15	8 39	7 34	6 40	5 27	9 00	8 20	11 53	0 17
Frid.....	16	9 11	8 35	7 11	6 25	9 45	9 18	P.M.	0 45
Sat.....	17	9 39	9 36	7 37	7 22	10 27	10 16	2 27	1 10
Sun.....	18	10 06	10 32	7 59	8 13	11 06	11 11	3 42	1 34
Mon.....	19	10 36	11 28	8 15	9 01	11 41	11 59	4 45	1 52
Tues....	20	11 04	P.M.	8 36	9 53	A.M.	P.M.	5 46	2 16
Wed....	21	11 36	1 05	9 03	10 48	0 14	1 30	6 42	2 35
Thur....	22	A.M.	1 48	9 34	11 35	0 46	2 11	large	small
Frid....	23	0 12	2 30	10 12	P.M.	1 18	2 51	8 03	3 15
Sat.....	24	0 53	3 15	10 53	1 20	1 53	3 32	8 31	3 41
Sun.....	25	1 40	3 57	11 40	2 18	2 35	4 12	8 51	4 23
Mon.....	26	2 32	4 38	A.M.	3 15	3 24	4 56	9 17	5 25
Tues....	27	3 33	5 21	0 41	4 17	4 18	5 44	9 50	6 41
Wed....	28	4 34	6 08	1 44	5 06	5 19	6 32	10 25	8 12
Thur....	29	small	large	small	large	small	large	11 04	9 44
Frid....	30	6 50	7 49	4 40	6 21	7 33	8 18	11 43	11 18
Sat.....	31	8 08	8 33	6 04	6 43	8 48	9 14	A.M.	P.M.

Monthly Mean of Sun's Semi-diameter, 15′ 51″.1

MAY, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 09	6 45	1 56	2 33 11	9.5	N.15 3 3	45.4	2 58.8	0.32
2	5 08	6 46	2 26	2 37 0	9.6	15 21 5	44.8	3 6.2	0.30
3	5 07	6 47	2 54	2 40 50	9.6	15 38 53	44.1	3 13.1	0.27
4	5 05	6 49	3 24	2 44 40	9.6	15 56 25	43.5	3 19.4	0.25
5	5 05	6 50	rises	2 48 31	9.6	16 13 41	42.8	3 25.2	0.23
6	5 04	6 51	8 17	2 52 22	9.6	16 30 41	42.2	3 30.4	0.21
7	5 03	6 52	9 26	2 56 14	9.7	16 47 24	41.5	3 35.1	0.18
8	5 02	6 52	10 28	3 00 6	9.7	17 3 51	40.8	3 39.2	0.16
9	5 01	6 53	11 19	3 3 59	9.7	17 20 1	40.1	3 42.7	0.13
10	5 00	6 54	morn	3 7 53	9.7	17 35 54	39.3	3 45.6	0.11
11	4 59	6 55	0 02	3 11 47	9.8	17 51 29	38.6	3 47.9	0.08
12	4 57	6 55	0 36	3 15 42	9.8	18 6 47	37.8	3 49.7	0.06
13	4 57	6 56	1 05	3 19 37	9.8	18 21 46	37.1	3 50.8	0.03
14	4 56	6 57	1 32	3 23 33	9.8	18 36 27	36.3	3 51.4	0.01
15	4 55	6 58	2 06	3 27 30	9.9	18 50 49	35.5	3 51.3	0.01
16	4 54	6 58	2 19	3 31 27	9.9	19 4 52	34.7	3 50.7	0.04
17	4 53	6 59	2 43	3 35 25	9.9	19 18 36	33.9	3 49.5	0.06
18	4 52	7 00	3 09	3 39 23	9.9	19 32 0	33.1	3 47.7	0.09
19	4 51	7 01	3 39	3 43 22	10.0	19 45 4	32.3	3 45.4	0.11
20	4 50	7 02	sets	3 47 22	10.0	19 57 48	31.4	3 42.5	0.13
21	4 50	7 03	7 47	3 51 22	10.0	20 10 12	30.6	3 39.0	0.15
22	4 49	7 03	8 41	3 55 22	10.0	20 22 15	29.7	3 35.0	0.18
23	4 49	7 04	9 31	3 59 23	10.1	20 33 57	28.8	3 30.5	0.20
24	4 48	7 05	10 15	4 3 25	10.1	20 45 18	27.9	3 25.4	0.22
25	4 48	7 06	10 55	4 7 27	10.1	20 56 17	27.0	3 19.9	0.24
26	4 47	7 06	11 28	4 11 30	10.1	21 6 55	26.1	3 13.9	0.26
27	4 47	7 07	11 59	4 15 33	10.1	21 17 11	25.2	3 7.4	0.28
28	4 46	7 08	morn	4 19 36	10.2	21 27 5	24.3	3 0.4	0.30
29	4 46	7 09	0 27	4 23 40	10.2	21 36 37	23.3	2 53.1	0.32
30	4 46	7 10	0 54	4 27 45	10.2	21 45 46	22.4	2 45.2	0.33
31	4 45	7 11	1 23	4 31 50	10.2	21 54 32	21.5	2 37.0	0.35

M.S.

Sun's Semi-diameter passing the Meridian, 1 7

JUNE, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Large.	Small.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Sun.	1	9 24	9 21	7 23	7 10	9 59	10 07	0 20	2 29
Mon.	2	10 40	10 02	8 27	7 37	11 15	10 55	1 00	4 00
Tues.	3	11 55	10 47	9 19	8 16	P.M.	11 43	1 34	5 25
Wed.	4	P.M.	11 29	10 15	9 00	1 22	A.M.	2 09	6 27
Thur.	5	1 51	A.M.	11 13	9 45	2 15	0 32	small	large
Frid.	6	2 43	0 12	P.M.	10 31	3 05	1 20	3 05	7 53
Sat.	7	3 29	1 01	1 10	11 14	3 46	2 05	3 54	8 22
Sun.	8	4 05	1 53	2 06	A.M.	4 25	2 49	4 58	8 49
Mon.	9	4 41	2 53	3 14	0 11	5 04	3 42	6 18	9 16
Tues.	10	5 18	3 55	4 15	1 07	5 43	4 40	7 41	9 45
Wed.	11	large	small	large	small	large	small	9 02	10 15
Thur.	12	6 49	6 04	5 31	3 25	7 15	6 41	10 23	10 45
Frid.	13	7 34	7 10	6 02	4 37	8 03	7 42	11 40	11 17
Sat.	14	8 13	8 15	6 23	6 08	8 50	8 43	P.M.	11 52
Sun.	15	8 50	9 18	6 47	7 19	9 36	9 44	2 27	A.M.
Mon.	16	9 25	10 24	7 13	8 34	10 19	10 48	3 49	0 24
Tues.	17	10 01	11 23	7 50	9 30	11 02	11 46	4 58	0 56
Wed.	18	10 38	P.M.	8 28	10 13	11 44	P.M.	large	small
Thur.	19	11 15	0 59	9 03	10 52	A.M.	1 24	6 24	1 46
Frid.	20	11 55	1 40	9 42	11 24	0 24	2 03	6 52	2 12
Sat.	21	A.M.	2 15	10 29	11 58	1 03	2 40	7 21	2 41
Sun	22	0 34	2 48	11 10	P.M.	1 38	3 15	7 44	3 30
Mon.	23	1 16	3 20	11 47	1 17	2 17	3 47	8 05	4 35
Tues.	24	2 08	3 50	A.M.	2 02	3 06	4 18	8 25	5 50
Wed.	25	small	large	0 35	2 47	3 58	4 56	8 51	7 14
Thur.	26	4 25	5 10	small	large	small	large	9 22	8 38
Frid.	27	5 39	6 07	2 30	4 07	6 03	6 33	9 58	10 03
Sat.	28	6 53	7 05	3 59	5 04	7 16	7 32	10 41	11 38
Sun.	29	8 13	7 58	5 55	5 58	8 36	8 34	11 23	P.M.
Mon.	30	9 35	8 18	7 28	6 47	9 54	9 37	A.M.	2 53

Monthly Mean of Sun's Semi-diameter, 15′ 46.9″.

JUNE, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *subtracted* from / *added* to Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	H. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	4 45	7 11	1 54	4 35 55	10.2	N. 22 2 56	20.5	2 28.4	0.37
2	4 45	7 12	2 31	4 40 0	10.2	22 10 57	19.5	2 19.4	0.38
3	4 44	7 12	3 14	4 44 6	10.3	22 18 34	18.6	2 10.0	0.40
4	4 44	7 13	rises	4 48 13	10.3	22 25 48	17.6	2 0.2	0.41
5	4 44	7 14	9 07	4 52 19	10.3	22 32 39	16.6	1 50.1	0.43
6	4 43	7 14	9 54	4 56 26	10.3	22 39 6	15.6	1 39.7	0.44
7	4 43	7 15	10 32	5 0 34	10.3	22 45 10	14.6	1 28.9	0.45
8	4 43	7 15	11 05	5 4 41	10.3	22 50 49	13.6	1 17.8	0.47
9	4 43	7 16	11 33	5 8 49	10.3	22 56 5	12.6	1 6.4	0.48
10	4 42	7 16	11 57	5 12 58	10.3	23 0 56	11.6	0 54.8	0.49
11	4 42	7 17	morn	5 17 6	10.4	23 5 23	10.6	0 42.9	0.50
12	4 42	7 17	0 22	5 21 15	10.4	23 9 26	9.6	0 30.8	0.51
13	4 42	7 18	0 46	5 25 24	10.4	23 13 4	8.6	0 18.4	0.52
14	4 42	7 18	1 12	5 29 33	10.4	23 16 18	7.6	0 5.9	0.52
15	4 42	7 19	1 41	5 33 42	10.4	23 19 7	6.5	0 6.8	0.53
16	4 42	7 19	2 13	5 37 52	10.4	23 21 31	5.5	0 19.6	0.54
17	4 42	7 19	2 52	5 42 1	10.4	23 23 30	4.5	0 32.5	0.54
18	4 42	7 19	3 37	5 46 11	10.4	23 25 5	3.4	0 45.6	0.54
19	4 42	7 20	sets	5 50 20	10.4	23 26 15	2.4	0 58.6	0.55
20	4 42	7 20	8 13	5 54 30	10.4	23 27 0	1.4	1 11.7	0.55
21	4 42	7 20	8 55	5 58 40	10.4	23 27 20	0.3	1 24.9	0.55
22	4 43	7 20	9 31	6 2 49	10.4	23 27 16	0.7	1 37.9	0.54
23	4 43	7 20	10 02	6 6 59	10.4	23 26 47	1.7	1 51.0	0.54
24	4 43	7 21	10 34	6 11 9	10.4	23 25 52	2.8	2 3.9	0.54
25	4 43	7 21	10 58	6 15 18	10.4	23 24 34	3.8	2 16.8	0.53
26	4 44	7 21	11 25	6 19 27	10.4	23 22 50	4.8	2 29.5	0.53
27	4 44	7 21	11 55	6 23 36	10.4	23 20 42	5.9	2 42.0	0.52
28	4 44	7 21	morn	6 27 45	10.4	23 18 9	6.9	2 54.4	0.51
29	4 45	7 21	0 27	6 31 54	10.4	23 15 11	7.9	3 6.5	0.50
30	4 45	7 21	1 06	6 36 3	10.3	23 11 50	8.9	3 18.4	0.49

M. S.
Sun's Semi-diameter passing the Meridian, 1 8.5.

JULY, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Tues....	1	10 56	9 39	8 35	7 31	11 11	10 37	0 05	4 28
Wed....	2	11 59	10 28	9 33	8 18	P.M.	11 31	0 51	5 36
Thur....	3	P.M.	11 19	10 25	9 05	1 17	A.M.	1 34	6 07
Frid....	4	1 39	A.M.	11 14	9 48	2 06	0 22	2 17	6 38
Sat.....	5	2 17	0 03	11 51	10 24	2 45	1 07	3 00	7 06
Sun.....	6	2 45	0 44	P.M.	11 02	3 17	1 49	4 02	7 27
Mon....	7	3 12	1 31	1 04	11 40	3 44	2 29	5 14	7 46
Tues....	8	large	small	1 41	A.M.	large	small	6 30	8 02
Wed	9	4 09	3 26	2 15	0 30	4 39	4 12	7 47	8 24
Thur....	10	4 51	4 32	large	small	5 21	5 08	9 06	8 53
Frid....	11	5 39	5 39	3 49	2 31	6 12	6 04	10 28	9 23
Sat.....	12	6 32	6 46	4 48	3 58	7 05	7 02	11 48	9 55
Sun.....	13	7 19	7 54	5 40	5 51	7 58	8 05	P.M.	10 28
Mon..	14	8 05	9 01	6 29	7 30	8 51	9 11	2 29	11 06
Tues....	15	8 47	10 07	7 13	8 27	9 43	10 20	large	small
Wed....	16	9 28	11 04	7 47	9 10	10 35	11 25	4 41	A.M.
Thur....	17	10 15	11 49	8 15	9 43	11 24	P.M.	5 13	0 33
Frid....	18	10 58	P.M.	8 46	10 12	A.M.	1 00	5 41	1 21
Sat.....	19	11 43	1 10	9 23	10 41	0 08	1 42	6 07	2 12
Sun.....	20	A.M.	1 44	9 58	11 11	0 48	2 14	6 25	3 04
Mon....	21	0 27	2 12	10 35	11 40	1 27	2 44	6 43	4 02
Tues....	22	1 10	2 36	11 25	P.M.	2 07	3 13	6 58	5 07
Wed....	23	small	large	A.M.	0 47	small	large	7 15	6 14
Thur	24	3 08	3 33	0 28	1 29	3 48	4 13	7 43	7 34
Frid....	25	4 23	4 21	small	large	4 50	5 02	8 14	9 00
Sat.....	26	5 43	5 22	3 24	3 28	6 01	6 02	8 55	10 35
Sun.....	27	7 05	6 24	5 21	4 35	7 15	7 03	9 41	P.M.
Mon....	28	8 27	7 27	6 50	5 37	8 36	8 09	10 29	1 49
Tues....	29	9 50	8 32	7 57	6 36	9 55	9 18	small	large
Wed....	30	11 00	9 29	8 55	7 28	11 12	10 21	A.M.	4 15
Thur	31	11 58	10 22	9 56	8 10	P.M.	11 19	0 10	5 00

Monthly Mean of Sun's Semi-diameter, 15 46.1.

JULY, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *added* to Apparent Time.	Diff. for One Hour.
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	4 46	7 21	1 54	6 40 11	10.3	N.23 8 4	9.9	3 30.1	0.48
2	4 46	7 21	2 52	6 44 19	10.3	23 3 53	10.9	3 41.6	0.47
3	4 47	7 21	3 58	6 48 27	10.3	22 59 19	11.9	3 52.7	0.46
4	4 47	7 20	rises	6 52 34	10.3	22 54 21	12.9	4 3.6	0.45
5	4 48	7 20	9 02	6 56 41	10.3	22 48 58	13.9	4 14.1	0.43
6	4 48	7 20	9 31	7 0 48	10.3	22 43 12	14.9	4 24.4	0.42
7	4 49	7 20	9 58	7 4 55	10.3	22 37 2	15.9	4 34.2	0.40
8	4 49	7 19	10 24	7 9 1	10.2	22 30 29	16.9	4 43.8	0.39
9	4 50	7 19	10 48	7 13 6	10.2	22 23 32	17.9	4 52.9	0.37
10	4 50	7 19	11 13	7 17 12	10.2	22 16 12	18 8	5 1.7	0.36
11	4 51	7 18	11 41	7 21 17	10.2	22 8 29	19.8	5 10.0	0.34
12	4 52	7 18	morn	7 25 21	10.2	22 0 23	20.7	5 18.0	0.32
13	4 52	7 17	0 12	7 29 25	10.2	21 51 55	21.7	5 25.5	0.30
14	4 53	7 17	0 49	7 33 29	10.1	21 43 3	22.6	5 32.6	0.28
15	4 54	7 16	1 31	7 37 32	10.1	21 33 50	23.5	5 39.1	0.26
16	4 55	7 16	2 22	7 41 35	10.1	21 24 14	24.4	5 45.2	0.24
17	4 56	7 15	3 19	7 45 37	10.1	21 14 17	25.3	5 50.9	0.22
18	4 57	7 15	sets	7 49 39	10.1	21 3 57	26.2	5 56.0	0.20
19	4 57	7 14	7 30	7 53 40	10.0	20 53 17	27.1	6 0.5	0.18
20	4 58	7 14	8 03	7 57 40	10.0	20 42 15	28.0	6 4.5	0.16
21	4 59	7 13	8 34	8 1 40	10.0	20 30 52	28.9	6 8.0	0.13
22	4 59	7 13	9 01	8 5 40	10.0	20 19 9	29.7	6 10.9	0.11
23	5 00	7 12	9 29	8 9 39	9.9	20 7 5	30.6	6 13.2	0.08
24	5 00	7 12	9 57	8 13 37	9.9	19 54 41	31.4	6 14.9	0.06
25	5 01	7 11	10 30	8 17 35	9.9	19 41 58	32.2	6 16.0	0.03
26	5 02	7 10	11 05	8 21 32	9.9	19 28 54	33.0	6 16.5	0.01
27	5 03	7 09	11 49	8 25 28	9.8	19 15 32	33.8	6 16.3	0.02
28	5 04	7 08	morn	8 29 24	9.8	19 1 50	34.6	6 15.6	0.04
29	5 04	7 07	0 42	8 33 19	9.8	18 47 50	35.4	6 14 3	0.07
30	5 05	7 06	1 42	8 37 14	9.8	18 33 31	36.2	6 12.3	0.09
31	5 06	7 05	2 52	8 41 8	9.7	18 18 54	36.9	6 9.7	0.12

M. S.

Sun's Semi-diameter passing the Meridian, 1 7.7

AUGUST, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.
		P.M.	P.M.	A.M.	P.M.	P.M.		A.M.	P.M.
Frid.....	1	0 37	11 06	10 12	8 46	1 01	A.M.	1 08	5 33
Sat.....	2	1 08	11 45	10 37	9 23	1 40	0 10	2 15	5 54
Sun.....	3	1 32	A.M.	11 02	9 55	2 10	0 55	3 25	6 16
Mon.....	4	large	small	11 30	10 33	large	small	4 35	6 26
Tues....	5	2 17	1 16	P.M.	11 04	2 56	2 14	5 41	6 30
Wed....	6	2 41	2 06	0 32	1 42	3 22	2 58	6 43	6 50
Thur....	7	3 10	3 00	1 05	A.M.	3 54	3 43	7 47	7 04
Frid.....	8	3 47	4 04	large	small	4 32	4 36	8 58	7 27
Sat.....	9	4 31	5 14	2 14	1 32	5 16	5 34	10 18	8 01
Sun.....	10	5 29	6 26	3 10	3 57	6 12	6 34	11 39	8 43
Mon.....	11	6 25	7 41	4 22	6 05	7 08	7 38	P.M.	9 27
Tues....	12	7 27	8 50	5 35	7 36	8 06	8 43	large	small
Wed....	13	8 18	9 52	6 30	8 35	9 05	9 48	3 08	11 05
Thur....	14	9 09	10 45	7 23	9 12	10 05	10 53	3 53	11 57
Frid	15	9 59	11 26	8 11	9 30	10 48	11 48	4 23	A.M.
Sat	16	10 46	P.M.	8 50	9 48	11 49	P.M.	4 45	1 03
Sun	17	11 30	0 32	9 24	10 07	A.M.	1 12	5 08	2 09
Mon. ...	18	A.M.	0 57	9 58	10 28	0 35	1 42	5 32	3 20
Tues....	19	small	large	10 37	10 51	small	large	5 50	4 31
Wed....	20	1 04	1 50	small	large	2 01	2 33	6 03	5 40
Thur....	21	1 58	2 22	A.M.	P.M.	2 44	3 00	6 15	6 52
Frid....	22	3 04	3 02	0 25	0 42	3 36	3 35	6 39	8 04
Sat.....	23	4 25	3 52	1 52	1 31	4 40	4 25	7 14	9 26
Sun.....	24	5 52	4 52	3 47	2 36	5 54	5 31	7 58	10 53
Mon.....	25	7 18	5 58	5 50	4 03	7 13	6 44	small	large
Tues....	26	8 40	7 08	7 04	5 17	8 37	7 58	9 59	P.M.
Wed....	27	9 46	8 14	7 55	6 18	9 52	9 07	11 06	3 01
Thur....	28	10 43	9 17	8 36	7 14	10 59	10 10	A.M.	3 47
Frid....	29	11 27	10 11	9 03	8 02	11 52	11 06	0 20	4 19
Sat.....	30	11 59	10 57	9 32	8 43	P.M.	11 55	1 38	4 43
Sun	31	P.M.	11 38	9 50	9 22	1 04	A.M.	2 42	4 59

Monthly Mean of Sun's Semi-diameter, 15′ 50.3″

AUGUST, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *added* to Apparent Time.	Diff. for One Hour
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 07	7 05	4 02	8 45 1	9.7	N.18 3 59	37.7	6 6.5	0.15
2	5 08	7 04	rises	8 48 54	9.7	17 48 47	38.4	6 2.7	0.17
3	5 09	7 03	7 59	8 52 46	9.7	17 33 17	39.1	5 58.3	0.20
4	5 10	7 02	8 25	8 56 37	9.6	17 17 29	39.8	5 53.3	0.22
5	5 11	7 01	8 49	9 0 28	9.6	17 1 25	40.5	5 47.7	0.25
6	5 11	7 00	9 15	9 4 19	9.6	16 45 5	41.2	5 41.5	0.27
7	5 12	6 59	9 42	9 8 9	9.6	16 28 28	41.9	5 34.7	0.29
8	5 13	6 58	10 12	9 11 58	9.5	16 11 35	42.5	5 27.4	0.32
9	5 13	6 57	10 45	9 15 46	9.5	15 54 26	43.2	5 19.5	0.34
10	5 14	6 56	11 26	9 19 34	9.5	15 37 2	43.8	5 11.0	0.36
11	5 15	6 55	morn	9 23 22	9.5	15 19 22	44.4	5 2.0	0.39
12	5 17	6 53	0 12	9 27 9	9.4	15 1 28	45.1	4 52.4	0.41
13	5 17	6 52	1 06	9 30 55	9.4	14 43 20	45.7	4 42.3	0.43
14	5 18	6 50	2 05	9 34 41	9.4	14 24 57	46.2	4 31.7	0.45
15	5 19	6 50	3 10	9 38 27	9.4	14 6 20	46.8	4 20.5	0.48
16	5 20	6 49	4 17	9 42 11	9.4	13 47 30	47.4	4 8.8	0.50
17	5 21	6 48	sets	9 45 56	9.3	13 28 27	47.9	3 56.6	0.52
18	5 22	6 47	7 04	9 49 39	9.3	13 9 10	48.4	3 43.8	0.54
19	5 22	6 46	7 35	9 53 23	9.3	12 49 42	48.9	3 30.6	0.56
20	5 23	6 44	8 02	9 57 6	9.3	12 30 1	49.4	3 16.9	0.58
21	5 24	6 43	8 32	10 0 48	9.3	12 10 8	49.9	3 2.7	0.60
22	5 25	6 41	9 07	10 4 30	9.2	11 50 4	50.4	2 48.0	0.62
23	5 25	6 40	9 48	10 8 11	9.2	11 29 49	50.9	2 32.8	0.64
24	5 26	6 39	10 38	10 11 52	9.2	11 9 23	51.3	2 17.2	0.66
25	5 27	6 37	11 35	10 15 32	9.2	10 48 46	51.7	2 1.2	0.68
26	5 29	6 36	morn	10 19 12	9.2	10 27 59	52.1	1 44.7	0.69
27	5 30	6 34	0 40	10 22 52	9.1	10 7 3	52.6	1 27.8	0.71
28	5 31	6 33	1 49	10 26 31	9.1	9 45 57	52.9	1 10.5	0.73
29	5 32	6 31	2 58	10 30 10	9.1	9 24 41	53.3	0 52.8	0.74
30	5 33	6 29	4 05	10 33 49	9.1	9 3 17	53.7	0 34.8	0.76
31	5 34	6 28	5 10	10 37 27	9.1	8 41 44	54.0	0 16.5	0.77

M. S.

Sun's Semi-diameter in passing the Meridian, 1 5.3

SEPTEMBER, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Small.	Large.
		P.M.		A.M.	P.M.	P.M.	A.M.	A.M.	P.M.
Mon....	1	0 40	A.M.	10 15	9 55	1 25	0 39	3 46	5 09
Tues....	2	0 55	0 14	10 38	10 28	1 46	1 19	4 49	5 20
Wed....	3	1 15	0 56	11 07	11 07	2 09	1 55	5 52	5 32
Thur....	4	1 43	1 45	11 32	11 55	2 33	2 34	6 55	5 45
Frid.....	5	2 19	2 43	11 56	A.M.	3 05	3 19	8 00	5 58
Sat.....	6	3 01	3 48	P.M.	0 58	3 44	4 10	9 03	6 24
Sun.....	7	3 50	4 57	1 11	2 11	4 30	5 09	10 13	6 56
Mon.....	8	4 45	6 04	2 13	4 15	5 22	6 08	large	small
Tues....	9	5 43	7 12	3 36	6 19	6 22	7 10	P.M.	8 20
Wed....	10	6 41	8 26	5 14	7 23	7 26	8 14	1 20	9 22
Thur....	11	7 41	9 14	6 29	8 01	8 32	9 18	2 14	10 38
Frid.....	12	8 42	10 05	7 15	8 32	9 35	10 19	2 58	11 59
Sat.....	13	9 40	10 45	7 53	8 55	10 36	11 13	3 35	A.M.
Sun.....	14	10 32	11 17	8 35	9 15	11 30	11 59	3 58	1 20
Mon.....	15	small	large	9 11	9 36	A.M.	P.M.	4 14	2 33
Tues....	16	A.M.	P.M.	9 50	9 57	small	large	4 28	3 41
Wed....	17	0 06	0 39	small	large	1 10	1 31	4 45	4 48
Thur....	18	1 04	1 08	11 32	10 51	1 59	1 59	5 01	6 02
Frid....	19	2 07	1 42	A.M.	11 22	2 47	2 31	5 18	7 18
Sat.....	20	3 17	2 24	0 48	P.M.	3 38	3 12	5 48	8 42
Sun....	21	4 38	3 21	2 17	0 51	4 40	4 07	small	large
Mon. ...	22	5 55	4 30	3 59	1 58	5 52	5 14	7 20	11 17
Tues....	23	7 13	5 45	5 34	3 34	7 10	6 28	8 18	P.M.
Wed....	24	8 26	6 57	6 47	5 17	8 25	7 41	9 32	1 10
Thur....	25	9 28	8 03	7 36	6 29	9 32	8 50	11 00	1 57
Frid....	26	10 11	9 02	8 04	7 18	10 28	9 54	A.M.	2 39
Sat.....	27	10 43	9 56	8 30	7 55	11 13	10 52	0 27	3 14
Sun.....	28	large	small	8 51	8 32	large	small	1 54	3 34
Mon.....	29	11 28	11 28	9 14	9 04	P.M.	A.M.	3 05	3 54
Tues....	30	11 46	A.M.	9 35	9 35	0 43	0 30	4 09	4 16

Monthly Mean of Sun's Semi-diameter, 15 57.1

SEPTEMBER, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon rises.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 34	6 27	6 52	10 41 5	9.1	N. 8 20 3	54.4	0 2.2	0.78
2	5 35	6 25	7 17	10 44 42	9.1	7 58 13	54.7	0 21.2	0.80
3	5 36	6 24	7 42	10 48 19	9.0	7 36 16	55 0	0 40.5	0.81
4	5 37	6 23	8 12	10 51 56	9.0	7 14 11	55.3	1 0.0	0.82
5	5 37	6 21	8 43	10 55 33	9.0	6 52 0	55.6	1 19.7	0.83
6	5 38	6 19	9 21	10 59 10	9.0	6 29 41	55.9	1 39.7	0 84
7	5 39	6 17	10 05	11 2 46	9.0	6 7 16	56.2	1 59.8	0.84
8	5 40	6 16	10 55	11 6 22	9.0	5 44 44	56.4	2 20.1	0.85
9	5 41	6 15	11 52	11 9 58	9.0	5 22 7	56.7	2 40.6	0.86
10	5 41	6 13	morn	11 13 34	9.0	4 59 24	56.9	3 1.3	0.86
11	5 42	6 12	0 53	11 17 10	9.0	4 36 36	57.1	3 22.0	0.87
12	5 43	6 11	1 58	11 20 45	9.0	4 13 43	57.3	3 42.8	0.87
13	5 44	6 09	3 05	11 24 21	9.0	3 50 45	57.5	4 3.8	0.87
14	5 45	6 07	4 14	11 27 56	9.0	3 27 43	57.6	4 24.8	0.88
15	5 46	6 05	sets	11 31 32	9.0	3 4 38	57.8	4 45.8	0.88
16	5 46	6 04	6 00	11 35 7	9.0	2 41 29	57.9	5 6.9	0.88
17	5 47	6 02	6 31	11 38 43	9.0	2 18 17	58.1	5 28.0	0.88
18	5 48	6 00	7 06	11 42 18	9.0	1 55 2	58.2	5 49.1	0.88
19	5 49	5 58	7 46	11 45 53	9.0	1 31 45	58.3	6 10.3	0.88
20	5 50	5 56	8 34	11 49 29	9.0	1 8 25	58.3	6 31.3	0.88
21	5 51	5 55	9 31	11 53 4	9 0	0 45 5	58.4	6 52.3	0.88
22	5 52	5 54	10 34	11 56 40	9.0	N. 0 21 42	58.4	7 13.3	0.87
23	5 52	5 52	11 41	12 0 16	9.0	S. 0 1 41	58.5	7 34.2	0.87
24	5 53	5 51	morn	12 3 51	9.0	0 25 5	58.5	7 54.9	0.86
25	5 54	5 50	0 49	12 7 27	9.0	0 48 29	58.5	8 15.6	0.86
26	5 55	5 48	1 56	12 11 3	9.0	1 11 53	58.5	8 36.1	0.85
27	5 56	5 47	3 02	12 14 39	9.0	1 35 17	58.5	8 56.4	0.84
28	5 57	5 45	4 04	12 18 16	9.0	1 58 40	58.4	9 16.6	0.83
29	5 58	5 44	5 03	12 21 52	9.0	2 22 2	58.4	9 36.5	0.82
30	5 59	5 43	6 03	12 25 29	9.0	2 45 23	58.3	9 56.1	0.81

Sun's Semi-diameter passing the Meridian, M. S. 1 4

OCTOBER, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Small.	Large.
		P.M.	A.M.	A.M.	P.M.	P.M.	A.M.	A.M.	P.M.
Wed....	1	0 07	0 05	9 57	10 07	1 07	1 02	5 04	4 38
Thur....	2	0 32	0 44	10 12	10 48	1 30	1 36	6 02	5 00
Frid. ...	3	0 59	1 33	10 35	11 42	1 57	2 15	7 04	5 22
Sat.....	4	1 33	2 33	10 54	A.M.	2 26	2 59	8 08	5 43
Sun.....	5	2 12	3 34	11 27	0 48	3 03	3 49	9 08	6 05
Mon.....	6	3 03	4 36	P.M.	2 13	3 52	4 44	large	small
Tues....	7	4 04	5 37	1 02	3 36	4 46	5 38	10 48	6 48
Wed....	8	5 07	6 36	2 13	4 58	5 45	6 36	11 34	7 51
Thur....	9	6 12	7 32	3 44	6 00	6 51	7 35	P.M.	9 08
Frid.....	10	7 17	8 24	5 10	6 55	8 01	8 33	1 00	10 32
Sat.....	11	8 19	9 10	6 12	7 32	9 11	9 31	1 38	A.M.
Sun.....	12	small	large	7 14	8 03	10 13	10 24	2 17	0 01
Mon.....	13	10 20	10 27	small	large	small	large	2 53	1 27
Tues....	14	11 18	10 55	8 55	8 45	A.M.	11 47	3 19	2 53
Wed....	15	A.M.	11 25	9 39	9 11	0 09	P.M.	3 38	4 12
Thur....	16	0 15	11 54	10 27	9 34	1 02	0 55	3 46	5 26
Frid.....	17	1 17	P.M.	11 24	9 58	1 55	1 30	4 01	6 38
Sat.....	18	2 24	1 14	A.M.	10 30	2 50	2 06	4 24	7 48
Sun.....	19	3 31	2 01	0 40	11 22	3 47	2 55	small	large
Mon.....	20	4 39	3 04	2 04	P.M.	4 43	3 57	5 52	9 51
Tues....	21	5 47	4 19	3 17	1 38	5 42	5 03	7 05	10 47
Wed....	22	6 52	5 31	4 35	3 10	6 50	6 11	8 29	11 36
Thur....	23	7 46	6 38	5 33	4 37	7 56	7 18	9 59	P.M.
Frid....	24	8 33	7 40	large	small	8 56	8 25	11 24	0 54
Sat.....	25	large	small	7 11	6 45	large	small	A.M.	1 29
Sun.....	26	9 46	9 38	7 40	7 31	10 28	10 25	0 47	1 58
Mon.....	27	10 11	10 29	8 02	8 12	10 59	11 19	2 09	2 24
Tues....	28	10 37	11 19	8 27	8 47	11 28	A.M.	3 24	2 44
Wed....	29	11 04	A.M.	8 51	9 30	11 54	0 06	4 35	2 54
Thur....	30	11 27	0 08	9 12	10 05	P.M.	0 50	5 36	3 06
Frid....	31	11 50	0 55	9 30	10 46	0 53	1 29	6 31	3 16

Monthly Mean of Sun's Semi-diameter, $16' 5.2''$

OCTOBER, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon rises.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	H. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 59	5 41	6 13	12 29 6	9.1	S. 3 8 42	58.3	10 15.6	0.80
2	6 00	5 39	6 45	12 32 43	9.1	3 31 59	58.2	10 34.7	0.79
3	6 01	5 37	7 20	12 36 21	9.1	3 55 14	58.1	10 53.5	0.78
4	6 02	5 36	8 01	12 39 59	9.1	4 18 26	57.9	11 11.9	0.76
5	6 03	5 34	8 48	12 43 38	9.1	4 41 35	57.8	11 30.1	0.75
6	6 04	5 32	9 42	12 47 16	9.1	5 4 41	57.7	11 47.8	0.73
7	6 05	5 31	10 40	12 50 56	9.1	5 27 44	57.5	12 5.1	0.71
8	6 06	5 29	11 42	12 54 35	9.2	5 50 42	57.3	12 22.0	0.69
9	6 07	5 28	morn	12 58 15	9.2	6 13 36	57.1	12 38.5	0.68
10	6 08	5 27	0 46	13 1 56	9.2	6 36 25	56.9	12 54.4	0.66
11	6 09	5 25	1 52	13 5 37	9.2	6 59 8	56.7	13 10.0	0.64
12	6 10	5 24	2 59	13 9 18	9.2	7 21 47	56.5	13 25.0	0.61
13	6 11	5 23	4 07	13 13 0	9.3	7 44 19	56.2	13 39.5	0.59
14	6 11	5 21	5 18	13 16 43	9.3	8 6 45	55.9	13 53.4	0.57
15	6 12	5 20	sets	13 20 26	9.3	8 29 4	55.6	14 6.9	0.55
16	6 13	5 19	5 39	13 24 10	9.3	8 51 15	55.3	14 19.7	0.52
17	6 14	5 18	6 25	13 27 54	9.3	9 13 20	55.0	14 32.0	0.50
18	6 15	5 16	7 20	13 31 39	9.4	9 35 16	54.7	14 43.7	0.47
19	6 17	5 14	8 23	13 35 24	9.4	9 57 4	54.3	14 54.8	0.45
20	6 18	5 13	9 32	13 39 10	9.4	10 18 42	53.9	15 05.3	0.42
21	6 19	5 11	10 41	13 42 57	9.5	10 40 12	53.5	15 15.1	0.40
22	6 20	5 10	11 50	13 46 44	9.5	11 1 32	53.1	15 24.4	0.37
23	6 21	5 09	morn	13 50 32	9.5	11 22 42	52.7	15 32.9	0.34
24	6 22	5 08	0 55	13 54 21	9.5	11 43 42	52.3	15 40.8	0.31
25	6 23	5 07	1 57	13 58 10	9.6	12 4 31	51.8	15 48.1	0.29
26	6 24	5 06	2 57	14 2 0	9.6	12 25 9	51.3	15 54.6	0.26
27	6 25	5 04	3 56	14 5 51	9.6	12 45 35	50.8	16 0.4	0.23
28	6 26	5 02	4 55	14 9 42	9.7	13 5 49	50.3	16 5.5	0.19
29	6 27	5 01	5 52	14 13 34	9.7	13 25 52	49.8	16 9.8	0.16
30	6 28	5 00	6 50	14 17 27	9.7	13 45 41	49.3	16 13.3	0.13
31	6 29	4 59	rises	14 21 21	9.8	14 5 17	48.7	16 16.1	0.10

M. S.

Sun's Semi-diameter passing the Meridian, 1 5.2

NOVEMBER, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
		P.M.	A.M.	A.M.	P.M.	P.M.	A.M.	A.M.	P.M.
Sat.....	1	0 19	1 44	9 48	11 37	1 24	2 08	7 17	3 33
Sun.....	2	0 57	2 33	10 12	A.M.	1 59	2 48	7 59	3 57
Mon....	3	1 42	3 23	10 47	0 47	2 37	3 32	8 39	4 28
Tues....	4	2 36	4 11	11 41	2 05	3 24	4 17	9 15	5 12
Wed....	5	3 35	5 01	P.M.	3 24	4 18	5 07	9 53	6 16
Thur....	6	4 34	5 50	2 12	4 36	5 18	5 56	10 35	7 38
Frid....	7	5 39	6 38	3 36	5 25	6 20	6 48	11 13	9 06
Sat.....	8	6 43	7 20	small	large	7 27	7 40	11 50	10 37
Sun. ..	9	small	large	5 54	6 26	small	large	P.M.	A.M.
Mon....	10	8 59	8 50	7 03	6 50	9 45	9 33	1 03	0 07
Tues....	11	10 10	9 36	8 05	7 23	10 55	10 22	1 39	1 35
Wed....	12	11 22	10 18	9 06	7 58	A.M.	11 07	2 08	3 07
Thur....	13	A.M.	10 56	9 57	8 29	0 02	11 49	2 27	4 27
Frid....	14	0 29	11 30	10 48	9 03	1 02	P.M.	2 49	5 55
Sat.....	15	1 32	P.M.	11 51	9 42	1 53	1 11	small	large
Sun.....	16	2 31	0 50	A.M.	10 36	2 46	1 55	3 49	7 57
Mon....	17	3 28	1 47	1 14	11 30	3 39	2 46	4 40	8 36
Tues....	18	4 18	2 50	2 35	P.M.	4 28	3 44	5 44	9 09
Wed....	19	5 07	3 53	3 49	1 25	5 21	4 45	7 03	9 48
Thur....	20	5 56	5 05	4 47	2 27	6 11	5 50	8 38	10 28
Frid....	21	large	small	large	small	7 03	6 54	10 11	11 12
Sat.....	22	7 34	7 20	6 02	5 02	large	small	11 39	11 49
Sun ...	23	8 16	8 21	6 31	6 20	8 41	9 01	A.M.	P.M.
Mon....	24	8 50	9 19	6 58	7 28	9 26	10 04	1 02	0 49
Tues	25	9 22	10 15	7 17	8 21	10 06	11 02	2 21	1 09
Wed....	26	9 53	11 11	7 42	9 05	10 43	11 53	3 37	1 30
Thur....	27	10 24	A.M.	8 10	9 48	11 17	A.M.	4 45	1 50
Frid....	28	10 54	0 06	8 34	10 27	11 51	0 40	5 45	2 13
Sat.....	29	11 23	0 57	8 55	11 09	P.M.	1 20	large	small
Sun.....	30	P.M.	1 46	9 23	11 54	1 05	1 58	7 13	2 59

Monthly Mean of Sun's Semi-diameter, 16′ 12.7″.

NOVEMBER, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon rises.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	H. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	6 30	4 59	6 44	14 25 16	9.8	S. 14 24 40	48.2	16 18.1	0.07
2	6 31	4 58	7 36	14 29 11	9.8	14 43 49	47.6	16 19.2	0.03
3	6 32	4 57	8 33	14 33 7	9.9	15 2 44	47.0	16 19.6	0.00
4	6 33	4 56	9 31	14 37 4	9.9	15 21 24	46.4	16 19.1	0.04
5	6 34	4 54	10 34	14 41 2	9.9	15 39 49	45.7	16 17.8	0.07
6	6 35	4 52	11 37	14 45 1	10.0	15 57 59	45.1	16 15.7	0.11
7	6 36	4 51	morn	14 49 1	10.0	16 15 52	44.4	16 12.6	0.14
8	6 37	4 50	0 42	14 53 1	10.0	16 33 30	43.7	16 8.8	0.18
9	6 38	4 49	1 46	14 57 2	10.1	16 50 50	43.0	16 4.1	0.21
10	6 39	4 48	2 54	15 1 4	10.1	17 7 54	42.3	15 58.5	0.25
11	6 40	4 47	4 04	15 5 7	10.1	17 24 40	41.5	15 52.0	0.29
12	6 41	4 46	5 18	15 9 11	10.2	17 41 8	40.8	15 44.7	0.32
13	6 43	4 45	sets	15 13 16	10.2	17 57 17	40.0	15 36.5	0.36
14	6 44	4 44	5 02	15 17 22	10.2	18 13 8	39.2	15 27.5	0.49
15	6 45	4 44	6 04	15 21 28	10.3	18 28 40	38.4	15 17.6	0.43
16	6 46	4 43	7 13	15 25 36	10.3	18 43 52	37.6	15 6.8	0.46
17	6 47	4 43	8 25	15 29 44	10.4	18 58 44	36.7	14 55.3	0.50
18	6 48	4 42	9 37	15 33 53	10.4	19 13 15	35.9	14 42.9	0.53
19	6 49	4 42	10 46	15 38 2	10.4	19 27 26	35.0	14 29.7	0.57
20	6 50	4 41	11 50	15 42 13	10.5	19 41 16	34.1	14 15.7	0.60
21	6 51	4 41	morn	15 46 24	10.5	19 54 44	33.2	14 1.0	0.63
22	6 52	4 40	0 12	15 50 36	10.5	20 7 50	32.3	13 45.4	0.66
23	6 53	4 40	1 51	15 54 49	10.6	20 20 34	31.4	13 29.1	0.70
24	6 54	4 40	2 49	15 59 3	10.6	20 32 56	30.4	13 12.0	0.73
25	6 55	4 39	3 47	16 3 18	10.6	20 44 54	29.5	12 54.2	0.76
26	6 56	4 39	4 45	16 7 33	10.6	20 56 30	28.5	12 35.6	0.79
27	6 57	4 39	5 42	16 11 49	10.7	21 7 41	27.5	12 16.3	0.82
28	6 58	4 38	rises	16 16 5	10.7	21 18 29	26.5	11 56.2	0.85
29	6 59	4 38	5 32	16 20 23	10.7	21 28 53	25.5	11 35.5	0.88
30	7 00	4 38	6 27	16 24 41	10.8	21 38 53	24.5	11 14.0	0.91

Sun's Semi-diameter passing the Meridian, M. S. 16 8.4.

DECEMBER, 1879.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER. Large.	*San Francisco.* HIGH WATER. Small.	*San Diego.* HIGH WATER. Large.	*San Diego.* HIGH WATER. Small.	*Astoria.* HIGH WATER. Large.	*Astoria.* HIGH WATER. Small.	*Port Townsend.* HIGH WATER. Large.	*Port Townsend.* HIGH WATER. Small.
		P.M.	A.M.	A.M.		P.M.	A.M.	A.M.	P.M.
Mon. . .	1	0 39	2 28	9 52	A.M.	1 43	2 36	7 40	3 31
Tues. . . .	2	1 24	3 04	10 31	0 48	2 22	3 14	8 01	4 19
Wed. . . .	3	2 11	3 36	11 15	1 39	3 03	3 51	8 26	5 21
Thur. . . .	4	3 04	4 08	P.M.	2 28	3 51	4 30	8 52	6 36
Frid	5	4 05	4 44	1 16	3 13	4 47	5 10	9 24	7 53
Sat.	6	small	large	small	large	small	large	9 55	9 16
Sun.	7	6 28	6 19	4 10	4 35	7 10	6 45	10 30	10 42
Mon. . . .	8	7 48	7 14	5 34	5 19	8 12	7 40	11 07	A.M.
Tues. . . .	9	9 07	8 03	6 51	6 04	9 26	8 37	11 44	0 19
Wed	10	10 19	8 51	8 06	6 46	10 44	9 33	P.M.	2 00
Thur. . . .	11	11 24	9 35	9 05	7 28	11 55	10 27	1 07	3 43
Frid	12	A.M.	10 16	10 04	8 12	A.M.	11 18	1 43	5 08
Sat.	13	0 29	11 03	10 53	8 51	0 58	P.M.	small	large
Sun.	14	1 32	11 50	11 48	9 37	1 56	0 55	2 37	6 52
Mon	15	2 25	P.M.	A.M.	10 18	2 43	1 44	3 22	7 27
Tues. . . .	16	3 08	1 27	0 37	11 08	3 27	2 31	4 36	7 59
Wed. . . .	17	3 45	2 30	1 32	11 55	4 06	3 22	6 03	8 28
Thur. . . .	18	4 09	3 36	2 21	P.M.	4 40	4 20	7 25	8 50
Frid	19	large	small	large	small	large	small	8 51	9 17
Sat.	20	5 30	5 49	3 58	2 57	6 00	6 25	10 17	9 47
Sun.	21	6 23	6 51	4 35	4 15	6 50	7 27	11 41	10 15
Mon	22	7 14	7 57	5 22	5 48	7 42	8 28	A.M.	10 44
Tues. . . .	23	7 57	9 04	6 00	7 21	8 33	9 34	1 08	11 15
Wed. . . .	24	8 33	10 11	6 43	8 27	9 21	10 35	2 29	11 49
Thur . . .	25	9 11	11 13	7 19	9 20	10 07	11 31	3 47	P.M.
Frid	26	9 48	A.M.	7 57	9 59	10 48	A.M.	4 54	1 01
Sat.	27	10 27	0 04	8 30	10 32	11 30	0 22	large	small
Sun.	28	11 07	0 46	9 04	11 10	P.M.	1 08	6 08	2 10
Mon	29	11 45	1 23	9 41	11 46	0 49	1 50	6 34	2 42
Tues. . . .	30	P.M.	1 54	10 12	A.M.	1 28	2 24	6 55	3 24
Wed. . . .	31	1 03	2 26	10 45	0 21	2 05	2 54	7 12	4 22

Monthly Mean of Sun's Semi-diameter, 16′ 17.2″.

DECEMBER, 1879.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon rises.	The Sun's Right Ascension at Greenwich, Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time, to be *subtracted* from / *added* to Apparent Time.	Diff. for One Hour.
	H.M.	H.M.	H.M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	7 01	4 38	7 25	16 28 59	10.8	S. 21 48 27	23.4	10 51.9	0.93
2	7 02	4 38	8 27	16 33 19	10.8	21 57 37	22.4	10 29.2	0.96
3	7 03	4 37	9 28	16 37 39	10.8	22 6 21	21.3	10 5.8	0.99
4	7 04	4 37	10 31	16 41 59	10.9	22 14 40	20.2	9 41.8	1.01
5	7 05	4 37	11 34	16 46 21	10.9	22 22 33	19.2	9 17.2	1.04
6	7 06	4 37	morn	16 50 43	10.9	22 30 0	18.1	8 52.0	1.06
7	7 07	4 37	0 37	16 55 5	10.9	22 37 0	17.0	8 26.3	1.08
8	7 08	4 37	1 44	16 59 28	11.0	22 43 34	15.8	8 0.0	1.10
9	7 09	4 37	2 54	17 3 51	11.0	22 49 41	14.7	7 33.3	1.12
10	7 10	4 37	4 06	17 8 15	11.0	22 55 20	13.6	7 6.1	1.14
11	7 11	4 37	5 19	17 12 39	11.0	23 0 33	12.5	6 38.5	1.16
12	7 12	4 37	6 31	17 17 4	11.0	23 5 18	11.3	6 10.5	1.17
13	7 13	4 38	sets	17 21 29	11.0	23 9 36	10.2	5 42.1	1.19
14	7 14	4 38	6 00	17 25 54	11.1	23 13 26	9.0	5 13.4	1.20
15	7 15	4 38	7 14	17 30 20	11.1	23 16 48	7.8	4 44.4	1.21
16	7 15	4 38	8 26	17 34 46	11.1	23 19 43	6.7	4 15.1	1.22
17	7 16	4 38	9 35	17 39 12	11.1	23 22 9	5.5	3 45.7	1.23
18	7 16	4 39	10 40	17 43 38	11.1	23 24 7	4.3	3 16.1	1.24
19	7 17	4 39	11 41	17 48 4	11.1	23 25 37	3.2	2 46.3	1.24
20	7 17	4 39	morn	17 52 31	11.1	23 26 39	2.0	2 16.5	1.24
21	7 18	4 40	0 41	17 56 58	11.1	23 27 12	0.8	1 46.6	1.25
22	7 18	4 40	1 40	18 1 24	11.1	23 27 18	0.4	1 16.6	1.25
23	7 18	4 41	2 38	18 5 51	11.1	23 26 54	1.5	0 46.7	1.25
24	7 19	4 41	3 35	18 10 17	11.1	23 26 3	2.7	0 16.7	1.24
25	7 19	4 42	4 31	18 14 44	11.1	23 24 43	3.9	0 13.1	1.24
26	7 19	4 42	5 07	18 19 10	11.1	23 22 56	5.1	0 42.9	1.24
27	7 19	4 43	rises	18 23 36	11.1	23 20 40	6.2	1 12.5	1.23
28	7 20	4 43	5 18	18 28 3	11.1	23 17 55	7.4	1 42.0	1.22
29	7 20	4 44	6 20	18 32 28	11.1	23 14 43	8.6	2 11.3	1.22
30	7 20	4 44	7 22	18 36 54	11.1	23 11 3	9.7	2 40.4	1.21
31	7 20	4 45	8 24	18 41 20	11.1	23 6 55	10.9	3 9.2	1.20

M. S.

Sun's Semi-diameter passing the Meridian, 1 10.7

TO FIND THE TIME OF THE TWO LOW WATERS,

At San Francisco, San Diego, Astoria, Port Townsend, and Intermediate Points.

Turn to the Almanac for the required locality and day; and if the headings over the High Waters at the preceding change of tide are in the order *Large—Small*, the Moon's declination is North, and Table A is to be used. Count the number of days from the headings downward until the required day is reached; then add the time of High Water in the first column of the Almanac to the hours and minutes indicated for the same day in Table A, and the product will be the Low Water *large* next succeeding. To the time of High Water *small* of the same day, in the second column of the Almanac, add the hours and minutes given in Table B, and the product will be Low Water *small*. If the headings over the High Waters are in the order *Small—Large*, the Moon's declination is South, and the Tables are to be transposed by adding the quantities in Table B to the time of High Water in the first column of the Almanac, and the quantities in Table A to the second column.

Attention must be paid to the A.M. and P.M. headings, as the product will sometimes run into the morning of the following day. Should the locality be other than one of the four principal ports, turn to the Table of Tidal Constants and apply the proper correction. Where the changes of tide occur, the tides are omitted for those days to make room for the headings; in such cases they can be estimated very closely by proportion. The term *Large* indicates an *extreme* tide either of High or Low Water; the term *Small* indicates a *medium* tide.

San Francisco.			San Diego.			Astoria.			Port Townsend.		
Days.	A	B	Days.	A	B	Days.	A	B	Days.	A	B
	H. M.	H. M.		H. M.	H. M.		H. M.	H. M.		H. M.	H. M.
1	6 06	5 36	1	6 42	5 18	1	6 42	6 14	1	5 06	6 38
2	6 28	5 14	2	7 00	5 00	2	7 01	5 55	2	4 26	7 18
3	6 47	4 55	3	7 13	4 47	3	7 22	5 34	3	3 31	8 13
4	7 05	4 37	4	7 26	4 34	4	7 36	5 20	4	3 08	8 36
5	7 18	4 24	5	7 36	4 24	5	7 47	5 09	5	3 01	8 43
6	7 30	4 12	6	7 43	4 17	6	7 51	5 05	6	3 32	8 12
7	7 30	4 12	7	7 48	4 12	7	7 53	5 03	7	4 04	7 40
8	7 25	4 17	8	7 46	4 14	8	7 51	5 05	8	4 26	7 18
9	7 15	4 27	6	7 36	4 24	9	7 45	5 11	9	4 45	6 59
10	7 01	4 41	10	7 22	4 38	10	7 38	5 18	10	5 06	6 38
11	6 46	4 56	11	6 59	5 01	11	7 24	5 32	11	5 20	6 24
12	6 28	5 14	12	6 35	5 25	12	7 06	5 50	12	5 34	6 10
13	6 06	5 36	13	6 11	5 49	13	6 46	6 11	13	5 45	5 59

TIDAL CONSTANTS.

San Francisco Tide Table—(North Beach.)

To obtain the time of High Water at the following points, find the time for San Francisco: then for

		H.	M.
Fort Point	Subtract	0	20
Monterey	Subtract	1	43
Santa Cruz	Subtract	1	38
Half-Moon Bay	Subtract	1	43
South Farallon	Subtract	1	27
Saucelito	Subtract	0	35
Tomales Bay	Subtract	0	08
Bodega Bay	Subtract	1	02
Drake's Bay	Subtract	0	25
Point Reyes	Subtract	1	31
Peralta (San Francisco Bay)	Subtract	0	11
Point Wilson (San Francisco Bay)	Add	1	16
Mare Island (San Francisco Bay)	Add	1	33
Benicia (San Francisco Bay)	Add	2	04
Army Point (San Francisco Bay)	Add	1	54
Collinsville (San Francisco Bay)	Add	2	51
Sacramento City	Add	7	38
Guano Island (San Francisco Bay)	Add	0	08
Ravenswood (San Francisco Bay)	Add	0	30

NOTE.—The time of High Water on "San Francisco Bar" is about sixty-one minutes earlier than the computed time for San Francisco (North Beach); and at the "Heads" about forty minutes earlier. At the "Heads" the *current* changes from half an hour to one and a half hours after the change of tide; but during great freshets in the Bay, the mid-channel surface-current sometimes runs ebb during the whole of the flood tide.

San Diego Tide Table—(Near La Playa.)

To obtain the time of High Water at the following points, find the time for San Diego: then for

		H.	M.
Cape St. Lucas	Subtract	0	53
Margarita Island (Magdalena Bay)	Subtract	1	17
Man-of-War Cove (Magdalena Bay)	Subtract	1	13
Cuyler's Harbor (San Miguel Island)	Subtract	0	10
Prisoners' Harbor (Santa Cruz Island)	Subtract	0	20
Santa Barbara	Subtract	0	04
San Pedro	Add	0	06
Point Sal	Add	0	29
San Luis Obispo	Add	0	35

Astoria Tide Table.

To obtain the time of High Water at the following points, find the time for Astoria: then for

		H.	M.
Humboldt Bay (Humboldt Point)	Subtract	0	22
Humboldt Bay (Red Bluff)	Subtract	0	42
Humboldt Bay (Eureka)	Subtract	0	19
Crescent City	Subtract	1	04
Chetco River	Subtract	0	29
Trinidad Harbor	Subtract	1	07
Port Orford	Subtract	0	50
Coquille River	Subtract	1	12
Coos Bay (Pigeon Point)	Subtract	0	21
Coos Bay (north bend)	Add	0	56
Yaquina Bay	Subtract	0	27
Oysterville (Yaquina River)	Subtract	0	02
Tillamook Bay	Subtract	0	08
Clatsop (near Point Adams)	Subtract	0	07
Cape Disappointment	Subtract	0	10
Shoalwater Bay	Add	0	14
Destruction Island	Subtract	0	19
Nee-ah Harbor	Add	0	13
Ahosette (Nootka Sound)	Subtract	0	12
Fort Stevens (Columbia River)	Add	0	03
Skipennon Creek (Columbia River)	Add	0	09

Astoria Tide Table.—Continued.

		H.	M.
Tongue Point (Columbia River)	Add....	0	34
Marsh Island Creek (Columbia River)	Add....	1	00
Cathlamet (Columbia River)	Add....	1	46
Eagle Cliff (Columbia River)	Add....	2	19
Gray's Harbor	Subtract	0	02
Sitka	Add....	0	21

NOTE.—At the mouth of Columbia River the *current* changes from one-half hour to one hour after the change of tide; but during great freshets the ebb current lasts much longer than the ebb tide.

Port Townsend, W. T., Tide Table.

To obtain the time of High Water at the following points, find the time for Port Townsend: then for

		H.	M.
New Dungeness	Subtract	0	35
Restoration Point	Add....	0	15
Port Madison	Add....	0	26
Port Ludlow	Add....	0	07
Muckilteo	Add....	1	03
Port Blakeley	Add....	0	34
Seattle	Add....	0	32
Shilhole Bay	Add....	0	29
Steilacoom	Add....	0	58
Semi-ah-moo Bay	Add ..	1	07
Olympia	Add....	0	56

LIGHT-HOUSES ON THE WESTERN COAST.

(CORRECTED TO 1878.)

Description of the buildings, that they may be recognized in the daytime.

Point Loma.—A low tower (dark gray) rising from keeper's dwelling (yellow sandstone); lantern red; on the highest part of the point, and about half a mile from its extremity, and a little less than one mile S. 12½ W. from Ballast Point, marking the approach to San Diego Harbor. This point may be passed in safety within three-fourths of a mile. After crossing the bar, keep La Playa a little open to the eastward of Ballast Point (which can be passed within 20 yards) to enter the harbor. The anchorage is off La Playa.

Point Fermin.—Square wooden tower (light buff), rising from keeper's dwelling (light buff); dome of lantern, red.

Point Hueneme.—Square wooden tower (light buff); rising from keeper's dwelling (light buff); dome of lantern, red.

Santa Barbara.—A low tower (gray) rising from keeper's dwelling (gray); lantern, red; green shutters to windows.

Point Conception.—A low circular brick tower (white) rsing from keeper's dwelling (white); lantern red.

Piedras Blancas.—A white painted brick conical tower 90 feet high, with iron parapet and lantern; lantern and dome painted red.

Point Pinos.—A low round brick tower (white), rising from keeper's dwelling (dark gray stone); lantern red.

Santa Cruz.—A small square wooden tower (white), rising from keeper's dwelling (white, with green blinds); lantern white, with red dome.

Pigeon Point.—A conical brick tower (white); lantern black with red dome; keeper's dwelling, two stories, of wood, painted white, with red roof, and standing north-westward of tower.

South Farallon.—White conical tower, lantern red.

Point Bonita.—A low white tower, rising from the center of a one-story building.

Point Reyes.—A white tower of wrought iron, with sixteen sides; keeper's dwelling nearly white, and built 215 feet higher up the slope.

Point Arena.—A white conical brick tower; white lantern, with red dome; keeper's dwelling a large two-story brick building (white), standing 60 feet in the rear.

Cape Mendocino.—A white tower of wrought iron, polygon of 16 sides; lantern white, with red dome; keeper's dwelling of wood, standing 150 feet to the east-south-east of tower.

Humboldt.—White conical brick tower rising from keeper's dwelling.

Trinidad Head.—A brick tower, painted white, except the dome and railing, which are red; keeper's dwelling a two-story of wood, painted white, and standing 50 yards to the northeast.

Crescent City.—A low brick tower, painted stone color, rising from keeper's dwelling.

Cape Blanco.—A white circular tower; keeper's dwelling a two-story brick building, also white, standing 100 feet to the south.

Cape Arago (Gregory).—A white conical iron tower; dome of lantern red; keeper's dwelling 300 yards distant to the northeast.

Cape Foulweather (Yaquina Head).—A brick tower painted white; parapet lantern, painted black; keeper's dwelling, two-story, (white) 70 feet east.

Point Adams.—A low square tower of wood, painted light buff, rising from keeper's dwelling (light buff); lantern black, with red dome.

Cape Disappointment.—A low white conical tower rising from keeper's dwelling (white); lantern red.

Shoalwater Bay.—A low white tower rising from keeper's dwelling, both of brick, lantern red.

Cape Flattery.—A brick tower, (white), rising from keeper's dwelling (gray stone); lantern red.

Ediz Hook.—A square white tower on keeper's dwelling, dome of lantern red.

New Dungeness.—A brick tower, yellow sandstone, rising from keeper's dwelling.

Smith's Island.—A low white brick tower rising from keeper's dwelling; two stories, of cement color; lantern red.

Admiralty Head.—A low square white tower rising from keeper's dwelling, lantern red.

Race Rocks.—A stone tower, painted with alternate horizontal black and white bands; keeper's dwelling of stone.

GEOGRAPHICAL POSITIONS

Of Important Headlands, Light-Houses, etc., on the Western Coast.

Name of Station.	Locality.	Latitude North.	Longitude West.	Variation East.
		° ′ ″	° ′ ″	° ′
Point Loma Light-House, 3 F W 24	W side entrance to San Diego Bay, 492 feet high	32 40 13	117 14 38	.....
Point Fermin Light-House, 4 Fl R and W 10 secs. 19	W side entrance to San Pedro Bay	33 42 19	118 17 37	.....
Point Hueneme L. H., 4 F Var by W Fl 10 secs, 13..	On mainland, Eastern ent. to Santa Barbara Chan'l	34 08 40	119 12 35	14 17
Santa Barbara Light-House, 4 F W 17	Two miles SW of landing, 180 feet	34 23 42	119 43 14	.....
Point Conception Light-House, 1 Rv W Fl ½ M 23..	Point Conception, 250 feet	34 26 50	120 28 00	.....
Piedras Blancas Light-House, 1 F V W F 15 secs, 18½	On the point, N W of entrance to San Simeon Bay..	35 39 45	121 15 46	14 58
Point Pinos Light-House, 3 F W 16	At N W point of the trees, 91 feet	36 37 52	121 56 00	.....
Santa Cruz Light-House, 5 F W 14	On Point Santa Cruz	36 57 00	122 01 32	.....
Pigeon Point Light-House, 1 W Fl every 10 secs, 18½	On Pigeon Point	37 10 50	122 23 35	.....
South Farallon L. H., 1 Rv W Pr Fl every M 26	23½ miles SW by W ¼ W off cnt. to S F Bay, 360 feet	37 41 49	123 00 04	.....
Point Lobos	South head of entrance to San Francisco Bay	37 46 50	122 29 39	15 18
Point Boneta Light-House, 2 F W 18	North head of entrance to San Francisco Bay, 150 ft.	37 49 04	122 37 50	.....
Fort Point Light-House, 5 F W 15	South side of entrance to San Francisco Bay, 83 feet	37 48 31	122 28 38	.....
Alcatraz Island Light-House, 3 F W 19	In the harbor of San Francisco, 166 feet	37 49 27	122 25 19	.....
Yerba Buena Island Light-House, 5 F W	On SE extremity of the Island	37 48 17	122 21 16	.....
East Brother Island L. H., S. F Bay, 4 Fl W 30 secs.	On East Brother Island, off Point San Pablo	37 57 39	122 26 01	16 08
Mare Island Light-House, 4 F W	Extreme East end of Mare Island	38 04 17	122 15 19	.....
Point Reyes Light-House, 1 flashes every 5 secs, 23.	On western part of head, 296 feet	37 59 39	123 01 16	.....
Point Arena Light-House, 1 F W 20	Near N W extremity of the point, 156 feet	38 57 10	123 44 47	17 24
Cape Mendocino Light-House, 1 W Fl 30 secs, 27. ..	West slope of Cape, 423 feet	40 26 17	124 24 24	.....
Humboldt LIght-House, 4 F W 12	On the N point one mile from entrance, 53 feet	40 46 04	124 13 21	.....
Trinidad Head Light-House, 4 FW Var by Red Flash	On Trinidad Head	41 03 00	124 08 56	.....
Crescent City Light-House, 4 F W Var by Fl 14	On the extreme W part of the point, 80 feet	41 44 34	124 12 22	18 54
Cape Blanco Light-House, 1 F W 22	On the highest part of the Cape	42 50 07	124 32 29	.....
Cape Gregory Light-House 4 F W Var by Fl 15	On small island at western extremity of Cape, 75 feet	43 20 38	124 22 20	.....
Cape Foulweather Light-House, 1 F W 18½	Westerly end of the Cape, 150 feet high	44 43 30	124 05 00	.....
Point Adams Light-House, 4 Fl R and W, 10 secs	On low ridge, entrance to Columbia River	46 11 36	123 58 40	21 05
Cape Disappointment Light-House, 1 F W 22½	Near the highest part of the Cape	46 16 33	124 03 13	.....
Cape Shoalwater Light-House, 4 F W Var by Fl 14.	N point of entrance to Shoalwater Bay, 87 feet	46 43 11	124 04 24	.....
Tatoosh Island Light-House, 1 F W 20	Off Cape Flattery, Strait of Juan de Fuca	48 23 15	124 43 48	22 02
Cape Beale Light-House, W Rv every 30 secs 19	SE point of entrance to Barclay Sound, 164 feet	48 47 30	125 12 50	.....
Ediz Hook Light-House, 5 F W 10	On False Dungeness, extremity of spit	48 08 25	123 24 07	.....
New Dungeness Light-House, 3 F W 16½	On the end of the Sand Point, Strait of Juan de Fuca	48 10 59	123 06 31	.....
Smith's Island L. H , 4 Rv W Var Fl every ½ m 15..	SW point of the island	48 19 11	122 59 36	.....
Admiralty Head Light-House, 4 F W 16	E side of entrance to Admirality Inlet, 119 feet	48 09 22	122 40 34	.....
Race Rocks Light-House, 2 W Fl every 10 secs	Southernmost point Vancouver, St. J. de Fuca, 118 ft.	48 17 59	123 31 23	.....
Fisgard Island Light-House, 4 F W G R 15	W side ent. Esquimault Bar, Strait Juan de Fuca, 70ft	48 25 54	123 26 35	.....
Atkinson Point Light-House, W Rv every M	N point of entrance to Burrard Inlet	.....	.....	.....

NOTE.—The numerals first given after each Light-House indicate the order of the Lights; F signifies fixed; Fl., flashing; Var. varied; Rv., revolving; Pr., prolonged; W, white; Rd., red; M, minutes, and the concluding numerals denote the distance at which the light may be seen, under ordinary states of the atmosphere, from a height of twenty feet above the sea.

FOG SIGNALS ON THE COASTS OF CALIFORNIA, OREGON, AND WASHINGTON TERRITORY.

(CORRECTED TO 1878.)

Point Conception.—A steam whistle with blasts of 8 seconds, at intervals of 52 seconds.

Point Ano Nuevo.—A steam whistle giving blasts of 15 seconds, with intervals of 45 seconds.

Pigeon Point.—A steam whistle giving blasts of 4 seconds duration, with alternate intervals of 7 and 45 seconds.

Point Montara.—A steam whistle giving blasts of 5 seconds, with an interval of 25 seconds; then a blast of 10 seconds, followed by an interval of 20 seconds.

Point Lobos.—A fog trumpet, erected by the Pacific Mail S. S. Co., for the benefit of their steamers; it is sounded during foggy weather, and may be heard seaward (dependent on the direction and strength of the wind) within the range of from six to ten miles.

Point Bonita.—A steam whistle (styled a Siren, from its peculiar sound) is placed on the extremity of the Point; the trumpet gives blasts of 4 seconds at intervals of 35 seconds.

Fort Point.—A bell struck by machinery every 10 seconds.

Alcatraz Island.—A bell, struck 4 blows at intervals of 9 seconds, followed by a pause of 28 seconds.

Yerba Buena Island, San Francisco Bay.—Fog bell, struck at intervals of 10 seconds. Used during the beginning of a fog. In addition, there is a steam whistle giving blasts of 4 seconds, with intervals of 16 seconds.

East Brother Island, San Francisco Bay.—Steam whistle, blasts of 8 and 4 seconds, with intervals of 24 seconds.

Mare Island, San Francisco Bay.—A bell, struck at intervals of every 10 seconds.

Point Reyes.—A steam whistle is placed at this point, giving blasts of 8 seconds, at intervals of 52 seconds.

Point Arena.—A steam whistle, giving blasts of five seconds, with intervals of 25 seconds.

Humboldt Bay.—On the north side of the entrance and three-fourths of a mile from the inlet, a first-class steam whistle, giving blasts of 4 and 8 seconds, with intervals of 24 seconds.

Point Adams, Mouth of Columbia River.—A steam whistle giving a blast of 7 seconds, with an interval of 14 seconds; then a blast of 4 seconds, followed by an interval of 35 seconds.

Cape Disappointment.—A bell, struck every 10 seconds.

Tatoosh Island.—A steam whistle is placed at the light-house, giving blasts of 8 seconds, at intervals of 52 seconds.

New Dungeness.—A steam whistle, giving blasts of 6 and 3 seconds, at alternate intervals of 12 and 39 seconds.

Table of Distances on West Coast of North America.

UP THE COAST.

From San Francisco—	Miles.		Miles.
To Ballenas Bay.....	14	To Tillamook Head....	533
Point Reyes	30	Cape Disappointment	552
Point Tomales.....	46	Shoalwater Bay	578
Bodega Head.....	50	Grey's Harbor.....	590
Fort Ross.....	65	Point Grenville.....	614
Point Arena.....	101	Cape Flattery.....	682
Mendocino City....	122	Port Angeles.....	738
Shelter Cove	166	Port Townsend.....	770
Cape Mendocino...	194	Seattle	808
Humboldt Bay.....	218	Steilacoom.....	838
Trinidad.....	235	Olympia	863
Crescent City.....	277	Victoria	748
Rogue's River.....	319	San Juan Island....	755
Port Orford.....	338	Bellingham Bay....	790
Cape Blanco.....	345	New Westminster...	820
Cape Gregory	376	Barclay Sound.....	724
Umpqua River.....	399	Nootka Sound.....	784
Cape Perpetua.....	434	Cordovo Bay.....	1178
Cape Foulweather..	460	Coronation Island...	1273
Cape Lookout.....	496	Sitka	1333
False Tillamook ...	520		

DOWN THE COAST.

From San Francisco—	Miles.		Miles.
To Pillar Point	26	To Point Vincent.....	365
Point Año Nuevo..	50	Point Loma.....	443
Santa Cruz.....	72	Port San Quentin..	555
Point Piños.....	90	Cerros Island.....	700
Point Sur.....	110	Magdalena Bay....	983
Point Gorda.....	142	Cape St. Lucas....	1143
Piedras Blancas.....	160	Cape Corrientes....	1413
San Simeon.....	165	Mazatlan	1336
Point San Louis.....	200	Guaymas	1488
Point Sal.....	215	Manzanillo.....	1518
Point Arguello.....	235	Acapulco.....	1820
Point Conception....	253	Realejo	2590
Santa Barbara	293	Nicaragua.....	2678
Anacapa Island.....	312	Coiba Island	3018
Santa Catalina.....	350	Panama.....	3260

PHASES OF THE MOON, 1879.

(San Francisco Mean Time.)

JANUARY.

	D.	H.	M.	
Full Moon	8	3	38	morn
Last Quarter	15	2	52	morn
New Moon	22	3	41	morn
First Quarter	30	3	35	morn
Perigee	14	9		morn
Apogee	28	10		even

FEBRUARY.

Full Moon	6	5	32	even
Last Quarter	13	10	44	morn
New Moon	20	7	53	even
First Quarter	28	11	48	even
Perigee	9	3		even
Apogee	25	4		even

MARCH.

Full Moon	8	5	0	morn
Last Quarter	14	7	31	even
New Moon	22	0	54	even
First Quarter	30	4	55	even
Perigee	9	5		even
Apogee	25	5		morn

APRIL.

Full Moon	6	2	15	even
Last Quarter	13	5	59	morn
New Moon	21	5	45	morn
First Quarter	29	6	6	morn
Perigee	7	2		morn
Apogee	21	10		morn

MAY.

Full Moon	5	10	3	even
Last Quarter	12	6	26	even
New Moon	20	9	41	even
First Quarter	28	3	27	even
Perigee	5	1		even
Apogee	18	1		even

JUNE.

Full Moon	4	5	26	morn
Last Quarter	11	8	46	morn
New Moon	19	0	9	even
First Quarter	26	9	46	even
Perigee	2	9		even
Apogee	15	2		morn
Perigee	30	9		even

JULY.

	D.	H.	M.	
Full Moon	3	1	28	even
Last Quarter	11	0	44	morn
New Moon	19	0	56	morn
First Quarter	26	2	26	morn
Apogee	12	7		even
Perigee	27	7		even

AUGUST.

Full Moon	1	11	2	even
Last Quarter	9	5	59	even
New Moon	17	0	1	even
First Quarter	24	7	2	morn
Full Moon	31	10	48	morn
Apogee	9	1		even
Perigee	21	10		even

SEPTEMBER.

Last Quarter	8	11	54	morn
New Moon	15	9	47	even
First Quarter	22	1	9	even
Full Moon	30	1	7	morn
Apogee	6	8		morn
Perigee	18	5		morn

OCTOBER.

Last Quarter	8	5	33	morn
New Moon	15	6	59	morn
First Quarter	21	10	9	even
Full Moon	29	5	59	even
Apogee	4	1		morn
Perigee	16	9		morn
Apogee	31	1		even

NOVEMBER.

Last Quarter	6	9	45	even
New Moon	13	4	29	even
First Quarter	20	10	45	morn
Full Moon	28	0	47	even
Perigee	13	8		even
Apogee	27	1		even

DECEMBER.

Last Quarter	6	11	33	morn
New Moon	13	2	54	morn
First Quarter	20	3	6	morn
Full Moon	28	8	6	morn
Perigee	12	8		morn
Apogee	24	7		even

SAILING DIRECTIONS

FOR APPROACHING AND ENTERING SAN FRANCISCO BAY.

From the U. S. C. S. Coast Pilot, 1869.

(The bearings given are Magnetic.)

In approaching the land in the vicinity of San Francisco, it is of great importance that accurate determination of their vessel's position should be often obtained by ship-masters, as fogs and thick weather are apt to prevail near the land.

Coming from the southward, it is customary to make the coast about Point Año Nuevo, (latitude 37 degrees 07 minutes north) and then to follow it up to the bar, keeping about four or five miles from the shore. If the weather be foggy or thick, vessels should keep closer to the shore so as not to lose it, as there are no dangers between Point Año Nuevo and the bar. In good weather pass Point Año Nuevo on a NW. by N. $\frac{3}{4}$ N. course, at about eight miles distance, and continue this course until you are abreast of Point San Pedro, five miles off; then steer N. $\frac{1}{2}$ E. for Point Bonita light-house, until you are within five-eighths of a mile of the south end of Bonita, and have Alcatraz light-house bearing NE. by E. $\frac{1}{2}$ E. of you open to the southward of Boneta. Now steer for Alcatraz light-house, passing nearly half a mile to the southward of Point Bonita, and one-third of a mile to the northward of Fort Point; and continue this course until the south end of Yerba Buena Island bears E. $\frac{1}{2}$ N., and you are nearly one and three-quarter miles from Alcatraz. Now steer E. $\frac{1}{2}$ N. for the south end of Yerba Buena, having the southern portion of the town of Oakland visible to the southward of it. This clears Blossom Rock. [NOTE—ED.: This rock has been removed, and the locality is marked with a buoy anchored in $22\frac{1}{2}$ feet of water at mean low tide.] On this course, when you are exactly between Alcatraz light-house and North Point, steer ESE. along the line of wharves, and anchor off the north-east front of the city in ten fathoms soft mud. But sailing vessels should be careful in using the course for Alcatraz light, as otherwise they may be carried too close to the northern shore, where they are apt to be becalmed and baffled with variable airs and strong current eddies, and are sometimes carried ashore. Care must be taken, on the other hand, not to approach Fort Point too close, as the currents set around it irregularly and with

great rapidity, and the bottom is uneven and rocky. Should the wind be so that the vessel cannot obtain the range of the light-house without tacking, then she may cross the bar with Bonita light-house bearing from N. by W. to NE. by E.; give Bonita a berth of a mile, and when within the heads, with Bonita abeam, gradually opening Alcatraz light-house north of Fort Point, until abeam of the latter, when proceed as before.

Coming from the westward, first sight South Farallon light-house, (latitude 37 degrees 42 minutes north) which leave to the northward, and steer NE. by E. seventeen miles, which will bring you close to the bar, and you will have Fort Point light exactly ahead of you. Now bring Alcatraz light to bear NE. by E. ½ E., when it will appear about midway between Point Bonita light and Fort Point light. Cross the bar on this course for Alcatraz, and proceed as before directed. From South Farallon light-house, Point Bonita light-house bears NE. by E., distant twenty-three and two-thirds miles.

Coming from the northward and westward, first make Point Reyes, which is 597 feet high, and is in latitude 38 degrees 0 minutes north, and longitude 123 degrees 0 minutes west. [A light has since been placed on this point.] Pass within two or three miles of it, but be careful not to get too close; for, although there are fifteen fathoms within a quarter of a mile of the shore, vessels are apt to lose the wind by getting under the Point. From Point Reyes steer ESE. twenty-two and a quarter miles, or until you open Alcatraz light-house to the southward of Point Bonita, when you must steer for Fort Point light-house about E. by N. ¾ N., and cross the bar on that range. On this course, when Point Bonita light-house bears NW. ½ N. a little abaft of the beam, Alcatraz light will bear NE. by E. ½ E., when you must steer for it and proceed as before directed.

DIRECTIONS FOR VESSELS IN THICK WEATHER.

Strangers approaching the entrance in thick weather should do so with great caution, carefully taking frequent soundings with not less than two hundred fathoms of line; and as soon as soundings are had within this depth, they should stand off and on until the weather clears, or a pilot can be had. The line of one hundred and fifty fathoms is distant four miles from North Farallon, nearly five miles from South Farallon, twenty-four miles from Point San Pedro, eighteen and a half miles from Pigeon Point, and seventeen miles from Point Año Nuevo. The neglect of this important precaution has caused the loss of several valuable vessels and many lives. Steamers in thick weather are accustomed, if their captains be well acquainted with the entrance, to run

close along the coast, and endeavor to make the land north of Point San Pedro, running in until they get about fifteen fathoms, and then lay a course for the bar, shoaling upon it to about five fathoms, and then gradually deepening, while the fog whistle gives them the direction of Bonita light-house. In this way shipmasters familiar with the entrance frequently run in during dense fogs; but strangers should never attempt it.

The United States sloop-of-war Vincennes, during the cruise of the exploring expedition, anchored on the bar in a calm, and when the flood-tide made, it brought up a swell that broke over her.

In beating out, vessels start on the last quarter of the flood, make the first tack to the northward of the Blossom Rock (since removed), and weather it on the second; thence they keep between Alcatraz and the south shore, avoiding Bird Rock, one mile west of the south end of the island, and giving a good berth to Fort Point, past which the ebb current will carry them rapidly (with a strong tendency toward the south shore), and a couple more tacks carry them clear of the Heads. If the vessel be bound to the northward, and the weather shut in thick, with the wind to the northwest, she makes a tack off shore to the southward of the Farallones; if the weather be clear, short tacks are made off shore, until she works up to Point Reyes, because the sea to the leeward of that headland is much smoother, and the current less: then stand off until a course can be made for her port.

THE WINDS.

It has been advised to work close along shore to northern ports during the summer northwest winds, and take the chances of land-breeze, to make latitude; but the attempt will double the length of any voyage. Baffling light airs and calms frequently exist along the coast, while vessels several hundred miles off have strong northwest winds. Moreover, along the coast we know the current frequently sets two miles per hour from the northward, except very close under the shores. In our experience, we never yet have met a wind off the land north of San Francisco, and very rarely indeed south of it, except in the region of Santa Barbara Channel. As a general rule it may be safely stated that the summer winds follow the line of the coast, nearly, and gradually draw toward and over the land. In winter, with winds from the southward, this is not so marked.

From April to October, inclusive, the prevailing wind is from the northwest, changing to west in valleys opening upon the coast, but in no case so strongly as through the Golden Gate.

During the summer the wind sets in strong about ten A. M., increas-

ing until nearly sunset, when it begins to die away. During its height it almost regularly brings in a dense fog, which, working its way over the peninsula, meets that already advanced through the Golden Gate, and envelopes San Francisco and the bay by sunset. As a rule, the breeze does not dispel the fog. If a fog exists outside, the wind is sure to bring it in, but the heated earth dissipates it for a time.

From November to March the wind is frequently from the southeast, blowing heavily, working round to the southwest, with a large and broken swell from the southwest, weather thick, rainy, and squally; the wind not unfrequently ending at northwest, with an ugly cross-sea. During heavy south-easters, the sea breaks upon the San Francisco bar, clean across the entrance, presenting a fearful sight. The sound can be heard at the anchorage in front of the city.

During some winters a hard "norther" will spring up, and blow steadily and strongly from one to five days, with a clear blue sky, and cold, bracing weather. Winds rarely blow from points between north, round by the east to southeast.

The further north we advance, the heavier blow the gales in winter. The northwest winds are not predicted by the barometer, but those from the southeast are, almost invariably—the mercury falling one inch from its usual height of about thirty inches. When it begins to rise, the wind may be expected soon to shift round by the west, and to decrease.

[Note, Ed.—The foregoing article on sailing directions for approaching and entering the Bay of San Francisco has been continued in this edition of the "Nautical Almanac" in order to be a guide, in case of the loss or displacement of the buoys now marking the approaches to the harbor; but its present use, except in such case, is supplemented by the following article on buoys and beacons, with accompanying directions, corrected to 1878.]

DIRECTIONS FOR COLORING, NUMBERING, AND PLACING BEACONS, BUOYS, SPINDLES, STAKES, ETC.

In conformity to the terms of the Act of Congress approved September 28th, 1850, prescribing the manner of coloring and numbering the buoys along the coasts and in the bays, sounds, rivers, and harbors of the United States, the following order must be observed, viz:

1. In approaching the channel, &c., from seaward, RED BUOYS, WITH EVEN NUMBERS, will be found on the STARBOARD side of the channel, and must be left on the STARBOARD hand in passing in.

2. In approaching the channel, &c., from seaward, BLACK BUOYS,

with ODD NUMBERS, will be found on the PORT side of the channel, and must be left on the PORT hand in passing in.

3. BUOYS painted with RED and BLACK (horizontal) STRIPES will be found on obstructions, with channel ways on either side of them, and may be left on either side in passing in.

4. BUOYS painted with WHITE and BLACK (perpendicular) STRIPES will be found in MID-CHANNEL, and must be passed close-to, to avoid danger.

5. All other distinguishing marks to buoys will be in addition to the foregoing, and may be employed to mark particular spots, a description of which will be given in the printed list of buoys.

6. Perches, with balls, cages, &c., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

7. No deviation from the foregoing directions will be permitted.

BUOYS MARKING THE ENTRANCE TO SAN FRANCISCO HARBOR,

Arranged in regular order as they are passed by vessels in entering. (Bearings from the buoys are by compass, distances in nautical miles.)

Noonday Rock Buoy.—Mammoth nun buoy, painted with red and black horizontal stripes. Point Reyes (extreme point) bears N. by E. ¼ E., distant 14⅛ miles; Duxbury Point, NE. by E, ⅛ E.; Point Bonita Lighthouse, E. by N. ¾ N., distant 30⅛ miles; South Farallon Lighthouse, E. by S. ½ S., distant 9⅔ miles.

This buoy is placed on Fanny Shoal, in 25 fathoms of water. Noonday Rock bears SE. by E., distant three-quarters of a mile. It cannot be placed on or near the rock, owing to the immense depth of water; it can be seen in clear weather at a distance of 3½ miles. Mariners should not open the North and South Farallones to the southward to avoid Noonday Rock.

Outside Bar Buoy.—Courtenay's automatic signal buoy. Painted with black and white vertical stripes. End of Point Reyes bears NW. by W. ⅞ W., distant 22½ miles; Point Bonita Lighthouse, NE., distant 7¾ miles; buoy inside bar, NE. by E., distant 4⅔ miles; Fort Point and Alcatraz Lights, just open, NE. ⅞ E; Point Pedro, SE. ¾ E.

This buoy is placed outside the bar in 15¼ fathoms, (mean low water) sandy bottom, and may be passed close to on either side. In ordinary smooth sea the buoy can be heard at the distance of a mile; in a heavy sea much further. Course to inner buoy, NE. by E., distant 4⅔ miles.

South Shoal Buoy.—First-class nun buoy, painted with black and

red horizontal stripes. Point Bonita Lighthouse bears NNE.; Seal Rock, NE.; Fort Point and Mile Rock in one, NE. ½ N. This buoy lies on a small shoal just inside the bar, and should be given a berth of half a mile on either side. Just inside the buoy it breaks whenever there is a heavy swell on the bar.

West End of Four-fathom Bank.—Number 1, first-class iron nun buoy, painted black; Ballenas Point bears NW. ¾ W.; Seal Rock, E. ⅜ S. Buoy east end Four-fathom Bank, ENE., distant 3⅛ miles.

This buoy is placed on the west end of Four-fathom Bank, in sandy bottom. Vessels coming from the north in smooth weather may cross the bar by leaving this buoy on the port side, and then steer east for Point Lobos until in line with Fort Point and Alcatraz Island, and then steer for buoy between the Heads.

Inside Bar Buoy —First-class iron nun buoy, painted with black and white vertical stripes; Ballenas Point bears NW. by W. ¼ W.; Seal Rock, E. ½ N. Buoy between the Heads, NE. by E. ¼ E., distant 2½ miles.

This buoy is placed inside the bar, in sandy bottom, and may be passed close to on either side. Course from this buoy to buoy between the Heads, NE. by E. ¼ E., distant 2½ miles.

East End of Four-Fathom Bank.—Number 3, first-class iron nun buoy, painted black. Fort Point Lighthouse bears E. by N. ½ N.; Point Bonita Lighthouse, NE. by E. ⅞ E.; Seal Rock, SE. by E. ⅛ E.

This buoy is placed on the east end of Four-fathom Bank; to be left on the port side, giving it a good berth.

Mid-Channel Buoy, between the Heads.—First-class iron can buoy, painted with black and white vertical stripes. Seal Rock bears SSE. ¾ E.; Point Bonita Lighthouse, NNW. ½ W.; Fort Point, NE., ⅝ E., distant 2⅛ miles.

This buoy is placed in sandy bottom. After passing this buoy, and in passing Fort Point, a good berth should be given, as the ebb tide is very strong and irregular, and sets directly upon it, making a very dangerous eddy between it and Mile Rock, for which reason the north shore should have the preference.

Fort Point Ledge.—Number 2, second-class can buoy, painted red. Point Diablo bears W. ⅞ S.; Lime Point, N. by W. ½ W.; Mid-channel buoy, between the Heads, S. ½ W.

This buoy should be given a good berth, for the tide sweeps in on the ledge with great force.

Presidio Shoal.—Second-class iron can buoy, painted with black and red horizontal stripes. Fort Point bears SW. by W. ½ W.; Anita Rock Buoy, SSE. ½ E.; Alcatraz Lighthouse, NE. ½ E.

This buoy is placed near the middle of the shoal. All vessels may pass in safety on either side by giving it a berth of fifty yards.

Anita Rock.—Third-class iron nun buoy, painted with black and red horizontal stripes. Fort Point Lighthouse bears W. $\frac{3}{4}$ S.; Alcatraz Lighthouse, NE. $\frac{1}{2}$ N., distant $1\frac{3}{4}$ miles.

This buoy is placed on the north side of the rock, distant about 50 feet. The rock is bare at low water. To be left on the starboard side in entering, but may be passed on either side by small vessels.

Buoy on Wreck of Autocrat.—Third-class iron nun buoy, painted green, and marked WRECK, lying about 200 yards to the westward of Alcatraz Island.

Blossom Rock Buoy.—Second-class iron can buoy, painted with red and black horizontal stripes. Alcatraz Lighthouse bears W. by N.; Fort Point Lighthouse, WSW.; south side of Yerba Buena Island, E. $\frac{3}{8}$ S.; east side of Angel Island NW. by N. $\frac{1}{2}$ N. Anchored in $22\frac{1}{2}$ feet, low water, and should be given a good berth on either side, owing to the heavy tide-rip in that locality.

Yerba Buena Beacon—Pile beacon, crowned by box; painted with red and black horizontal stripes. Driven in sand and mud. North of beacon 12 and 14 feet of water, thence 16 and 18 to end of shoal.

Mission Bay Rock.—Third-class iron nun buoy, painted with black and red horizontal stripes. There is a depth of $12\frac{1}{2}$ feet on the rock at mean low water. The buoy is placed near the shoalest part of the rock, and may be passed on either side by giving it a good berth.

BUOYS AND BEACONS

Marking **San Francisco Bay, San Pablo Bay,** and **Napa Creek.** Depths of water given in feet at low spring tides. Bearings by compass.

Berkeley Reef.—Pile beacon, crowned by box; red and black horizontal stripes. West side of Brooks' Island bears NW. by W. $\frac{1}{4}$ W.; Alcatraz light SW. $\frac{1}{2}$ S. Beacon driven in seven feet of water (low tide) about one hundred yards west of reef.

South Hampton Shoal, lower end.—Pile beacon crowned by box, (in fourteen feet water) black and red horizontal stripes. Northwest end of Angel Island SW. $\frac{3}{4}$ W.; Point Richmond N. $\frac{1}{4}$ W. Beacon on upper end of shoal NW. $\frac{1}{4}$ W. This beacon may be passed on either side by giving it a good berth. The shoal runs southeast and northwest two and one-eighth miles.

South Hampton Shoal, upper end.—Pile beacon, crowned by box in eighteen feet water, black and red horizontal stripes. Red Rock bears NW. $\frac{1}{4}$ W.; south end of Angel Island S. by E. $\frac{1}{2}$ E.; Point Rich-

mond E. $\frac{3}{4}$ N. This beacon should be given a good berth in passing on either side.

Invincible Rock.—Third-class iron nun buoy, in thirteen feet water; black and red horizontal stripes. Buoy on Whiting Rock bears N. $\frac{1}{2}$ W.; Molate Point ESE. $\frac{1}{2}$ E. Point San Quentin, SW. $\frac{1}{2}$ W. This buoy is placed near the the shoalest part of the rock, on which there is 8 feet at low water. It may be passed on either side at a distance of fifty yards from the buoy.

Whiting Rock.—Second-class iron can buoy, in 18 feet water, black and red horizontal stripes. San Petro Point bears NNW. $\frac{3}{4}$ W.; San Pablo Point NE. $\frac{1}{2}$ N.; Point San Quentin SW. There is 12 feet on the shoalest part of the rock at low water, and it can be passed safely on either side at a distance of fifty yards from the buoy.

San Pablo Point.—Third-class iron nun buoy, Number 2, in 15 feet water, painted red. Pablo Point bears S. $\frac{1}{2}$ E.; light-house on East Brothers SSW. $\frac{1}{2}$ W. This buoy is placed about fifty feet north of a rock which is nearly bare at low water. It must be left on the starboard side when passing.

Shoal at Entrance to Mare Island Straits.—Pile beacon, crowned by box, in 10 feet water, black and red horizontal stripes. Magazine Wharf bears NW. $\frac{3}{4}$ N.; north head of Carquinez Strait E. $\frac{1}{8}$ S. This beacon is placed on the northeast side of the channel, near the bank, in hard sandy bottom, and at the turning point to Napa Creek, and must be left on the starboard side when going to Mare Island; port side when going to Benicia.

Commission Rock.—Second-class can buoy, in 15 feet water, black and red horizontal stripes. Railroad Point bears NE. by E. $\frac{3}{8}$ E.; flagstaff on barracks W. $\frac{3}{4}$ S.; Magazine Point SE. $\frac{1}{2}$ S. This buoy is about fifty yards S. by W. from the shoalest part of the rock, which is bare at low water and may be passed on either side, but the best water is on the port or west side.

Commission Rock Beacon.—Cylindrical beacon of boiler iron, surmounted by a spindle and glass reflector, painted with red and white horizontal stripes. This beacon is built on the shoalest part of the rock; care should be taken not to pass between it and the buoy.

To Mark Suisun Bay.

Pile Beacon crowned by box, in ten feet water, black and red horizontal stripes. Amy Point bears SW. $\frac{3}{4}$ W.; south end of Seal Island E. by N.; Beacon No. 1 ENE. $\frac{1}{4}$ E., distant three-fourths of a mile. Placed in muddy bottom. It must be left on the port side going up the Sacramento River. It is also at the turning point to Suisun Creek, and must be left on the starboard side by all vessels bound to that place.

Pile Beacon crowned by box, No. 1, in 10 feet water, painted black. Roe Island bears NNE. $\frac{3}{4}$ E.; north end of Seal Island ENE.; Point Edith SSW.; Beacon No. 3, NE. by E. distant one mile. Placed in hard bottom; must be left on the port side in passing. The channel is narrow, and the best water on the starboard side of it.

Pile Beacon, crowned by box, No. 3, in ten feet water, painted black. Upper end of Seal Island bears E. by S. Lower end of Seal Island, S. by E. $\frac{1}{2}$ E. Beacon No. 4, ENE. $\frac{5}{8}$ E., distant seven-eighths mile. Placed in soft, sticky bottom; must be left on the port side.

Pile Beacon, crowned by box, No. 4, in 10 feet water, painted red. Gillespie Point bears NE. $\frac{1}{2}$ N. Lower end of Rowe Island, WNW. $\frac{1}{8}$ W. North end Seal Island, SW. $\frac{7}{8}$ W. Placed in hard, sandy bottom, at the lower end of Middle Ground. To be left on the starboard side in passing.

Pile Beacon, crowned by box, in 9 feet water. Red and black horizontal stripes. East side of Montezuma Creek, bears N. $\frac{7}{8}$ W. North side of Suisun cut-off, E. SE. $\frac{7}{8}$ E. Bull's Head point, S. by W. $\frac{1}{8}$ W. Placed at the end of Mud Bank, between mouths of Montezuma and Suisun Creeks.

To Mark Petaluma Creek and Inlet.

Pile Beacon, crowned by box, No. 1, in 10 feet water, painted black. Petaluma Point bears WNW. Sonoma Point, N. $\frac{1}{8}$ E. Beacon No. 3, NW. $\frac{3}{8}$ N., distant $1\frac{1}{8}$ miles. This beacon must be left on the port side in passing. The best water is on the starboard side of the channel.

Pile Beacon, crowned by box, No. 3, in 10 feet water, painted black. Petaluma Point bears W. by N. Point Petro S. by E. $\frac{1}{4}$ E. Beacon No. 5, NW. $\frac{3}{4}$ W., distant one and one-eighth miles. Placed in soft, muddy bottom, and must be left on the port side in passing.

Pile Beacon, crowned by box No. 5, in 8 feet water, painted black. Petaluma Point bears W. $\frac{3}{4}$ S. Sonoma Point, NNE. $\frac{3}{4}$ E. Beacon No. 4, WNW., $\frac{1}{4}$ W., distant seven-eighths of a mile. Placed in soft, muddy bottom, and must be left on the port side when passing.

Pile Beacon crowned by box No. 4, in 10 feet water, painted red. Sonoma Point bears NE. by E. $\frac{1}{2}$ E. Mud Creek, NNW. $\frac{7}{8}$ W. Petaluma Point SW. $\frac{7}{8}$ W. Placed in soft, muddy bottom, and must be left on the starboard side in passing.

To Mark the Upper End of San Francisco Bay and Entrance to Redwood Creek.

San Mateo.—Pile beacon crowned by box, No. 2, in 10 feet water, painted red. Point San Mateo bears W. by S. $\frac{1}{4}$ S. Point San Bruno,

WNW. Point Avisadero, (Hunter's Point) NW. $\frac{1}{8}$ N. Placed in soft, muddy bottom, on side of channel. To be left to starboard.

Redwood Creek.—Pile beacon crowned by box, No. 4, in 8 feet water, painted red. Marsh Point bears SE. $\frac{1}{8}$ S. Potrero Point, E. by S. $\frac{3}{8}$ S. Beacon No. 1, SE. $\frac{5}{8}$ S. Placed in soft, muddy bottom, on side of channel. To be left to starboard.

Redwood Creek.—Pile beacon crowned by box, No. 6, in 7 feet water, painted red. Marsh Point bears S. by E. $\frac{3}{4}$ E. Beacon No. 4, W. by N. $\frac{1}{2}$ N. Placed in soft, muddy bottom. To be left to starboard.

Redwood Creek.—Pile beacon crowned by box, No 1, in 6 feet water, painted black. Marsh Point bears S. $\frac{1}{2}$ E. Beacon No. 4, NW. $\frac{5}{8}$ N. Beacon No. 6, NW. by N. $\frac{1}{4}$ N. Placed in soft, muddy bottom. To be left to port if bound into Redwood Creek, but well to starboard if bound to Point Potrero.

NOTICE OF ROCKS, SHOALS, AND DANGERS,

ADJACENT TO WEST COAST UNITED STATES.

Noonday Rock (off the entrance to San Francisco Bay.)—This danger has been removed, and its former site has 34 feet at mean low water; (designated by an immense buoy placed on Fanny Shoal;) but Lieutenant Weeden, U. S. Engineers, has discovered two pinnacles very close to it, over one of which there is but fourteen feet at mean low water, and deep water between them. As it is quite possible that an irregular ridge may connect these peaks of rocks with the North Farallon, large vessels are warned not to attempt to pass between them until a more thorough survey has been made.

The following magnetic bearings (determined by A. F. Rodgers, U. S. C. S.) show the former position of Noonday Rock.

Point Reyes, western head bears N. by E. $\frac{1}{4}$ E., distant 13 8-10 miles.

North Farallon, bears E. by S., distant 3 1-10 miles.

South Farallon light-house, bears E. by S. $\frac{3}{4}$ S., distant 9 7-10 miles.

Point Bonita light-house, bears E. by N. $\frac{5}{8}$ N., distant 30 3-10 miles.

Geographical position: latitude, 37 degrees 47½ N.; longitude, 123 degrees 09 W.

In the "Pilot" it is advised that vessels approaching the Golden Gate at night, or in thick weather, should keep to the southward of the South Farallon light. With Point Reyes and the Farallones in sight, vessels bound in, and running between them, should keep the western head of Los Reyes open on a NNE. course, coming nothing to the eastward until the North and South Farallones are in range, then bear away for the Golden Gate. In that position the rock will bear SE., distant

two and one third miles. Coming from the north-westward at night vessel should not bring the South Farallon light to bear anything east of SE. by E., which will clear the rock by two miles, and the North Farallones by one mile.

A Rock between the South and Middle Farallon (off San Francisco Harbor), supposed to have between three and four fathoms water on it, has been seen by pilots when it breaks.

Sunken Rock off Middle Farallon.—This danger has 5½ fathoms of water upon it at low water, with deep water—from eight to fifteen fathoms—close around it; but with a large sea on, a break has been seen upon it by pilots and the light-house keeper.

It lies S. 25 degrees W. by compass, distant three-eighths of a mile from the Middle Farallon; and N. 72 degrees W., distant 2¼ miles from South Farallon light-house.

The water between this rock and the Middle Farallon reaches 18 fathoms, and from 15 to 20 fathoms between it and the South Farallon.

Located in July, 1874, by Assistant Gershom Bradford, U. S. C. S.

Shoal near South Farallon.—A shoal or patch has been discovered (September, 1875) by Lieut. Com. H. C. Taylor, Assistant U. S. C. S., S. 50 degrees E., and distant one-half mile (both approximate) from the South Farallon light, with six and one-half fathoms upon it, sloping down from that to sixteen and eighteen fathoms on the outside, and to thirteen and fifteen fathoms on the inside.

Bursley Shoal—Reported by Captain Bursley, of the ship Vitula, in 1863, as being 80 miles SSW. (magnetic) from the South Farallon Island, and having from five to seven fathoms of water on it.

NOTE, ED.—The above shoal has been diligently searched for by several surveying vessels, but without success.

Newly Discovered Shoal-spots on San Francisco Bar.

In the recent detailed survey made by Assistant Gershom Bradford, of the U. S. Coast Survey, several shoal-spots have been discovered on the Bar off the Golden Gate.

I. A spot with 4½ fathoms, bears from Point Bonita light-house S. 5½ degrees W., distant six miles, and from Seal Rock S. 27 degrees W., distant 4 3-10 miles, and 3½ miles broad off shore; a neighboring lump with 4½ fathoms bears W. ½ N., distant 443 yards from the former.

II. A spot having 4½ fathoms, bears from Point Bonita light-house S. 20 degrees W., distant six miles, and from Seal Rock S. 43 degrees W., distant 4 9-10 miles; a neighboring lump bears NW. 545 yards from the former.

III. The centre of a narrow ridge about 50 yards wide, having spots

less than five fathoms, bears from Point Bonita light-house S. 37 degrees W., distant 5 7-10 miles, and from Seal Rock S. 60 degrees W., distant 5 1-10 miles. Its northern limit is about half a mile southward of the range of Alcatraz and Fort Point lights; and thence stretches 600 yards to the southward and eastward.

IV. A five-fathom spot off the western tail of the four-fathom bank, bears from Point Boneta light-house S. 55 degrees W., distant five miles, and from Seal Rock S. 82 degrees W., distant 5½ miles.

The deepest water directly over the bar is when Alcatraz Island is open a little more than its width from Fort Point, when scant six fathoms may be carried, and the bar is narrowest at this point.

The best water that can be carried into San Francisco Bay is through the Bonita Channel, where a depth of 8¼ fathoms is found, as in the old survey.

The bearings are magnetic; depths, at the mean of the lowest low waters; distances in nautical miles.

Wreck of ship Flying Dragon in San Francisco Bay.—In February, 1863, Aug. F. Rodgers, Assistant United States Coast Survey, reported the following bearings of the wreck of ship "Flying Dragon," and directions for avoiding it:

ARCH OR BIRD ROCK, E. (magnetic) distant 270 yards.
SHAG ROCK, N. by E. quarter N. (magnetic) distant 660 yards.

In sweeping for the "Flying Dragon," one of her spars was caught and held to with six fathoms of line out. It is not improbable that her topmast-heads come nearer the surface, and deep ships had better give the locality a good berth in working across the channel. There are twenty fathoms of water immediately around the wreck, with fourteen to seventeen fathoms half a ship's length distant on all sides. The intersection of the following ranges will show the position of the wreck: South side of Arch Rock in one with south beach of Yerba Buena Island, crossed by Saucelito Point Beach in one with Table Mountain Peak. Keeping the above ranges well open or closed, clears the wreck.

Shoal-spot in San Francisco Bay.—Located by Assistant Gershom Bradford, U. S. C. S.

The ridge extends in an irregular curved line from the north-west point of Alcatraz Island to the eastern end of the Presidio Shoal, and has an average width of 700 yards within the seven-fathom line.

The depth of water upon it is not regular, and the shoalest spot yet discovered has but four fathoms of water, over gravelly bottom, at the mean of the lowest low tides; but at the lowest spring tides there will be only 22 feet upon it.

This spot lies in the regular track of vessels, and is a danger to those of large draught. It is about 100 yards long, and the water around it deepens gradually to six fathoms S. by W. and N. by E. It lies S. 59 degrees E. (SE. by E. $\frac{1}{4}$ E.) by compass, distant 790 yards from Bird Rock; and S. 62 degrees W. (SW. by W. $\frac{1}{2}$ W.) by compass, distant 1260 yards from Alcatraz light. The following ranges also locate it: Shag Rock one with the eastern tangent of Peninsula Point; and Bonita light over the first small rise back of the brow of Mount Diablo.

The range Bonita light and the extremity of Mount Diablo passes one-fifth of a mile south of the shoal-spot.

Howell Rock, San Luis Obispo Harbor.—SE. by S. $\frac{1}{4}$ S. (magnetic), one mile distant from the end of People's Wharf. Has $14\frac{1}{2}$ feet on it at mean low water. Reported by Capt. Howell, steamer, "Los Angeles," June, 1875.

Dangerous Shoal in the Northern Approach to San Miguel Passage.

Lieut. Com. H. C. Taylor, U. S. N., Assistant Coast Survey, commanding steamer "Hassler," reports under date of August 22nd, 1875, the discovery of a dangerous shoal which lies to the northward of the NW. point of Santa Rosa Island, and about one mile from shore, with a least depth of eleven feet upon it; the bottom being rocky with occasional specimens of red and of white coral. There is no kelp on this shoal, and no breaker except in very heavy weather.

The depths in the vicinity range from seven to ten fathoms on all sides, with a rugged and irregular bottom.

The following bearings and distances fix the position of the center of the shoal: Northernmost point of San Miguel Island (known as Harris' Point), W. by N. $8\frac{1}{4}$ miles. Outermost rock off NW. point of Santa Rosa Island (known as Einder), S. by W. $\frac{1}{2}$ W. $1\frac{1}{2}$ miles. The most prominent point in the north face of Santa Rosa Island, (Brockway Point) ENE. $\frac{5}{8}$ E. $5\frac{1}{4}$ miles. Eastern end of San Miguel Island, (known as Cardwell Point) WSW. $\frac{1}{4}$ W. $4\frac{1}{4}$ miles.

All vessels attempting the San Miguel Passage are cautioned not to allow the outer rock off the northwest point of Santa Rosa to bear anything to the southward or westward of S. by E., and sailing vessels are specially recommended to avoid this passage altogether, as the light airs and calms under the lee of San Miguel Island, and the strong currents in the vicinity, combine frequently to drive a vessel upon this dangerous spot.

Other dangers, not yet developed, are believed to exist to the eastward of this.

To the northward of the shoals, and three-fourths of a mile distant, a band of kelp extends one-fourth of a mile in an easterly and westerly direction, with twelve and fifteen fathoms of water in and around it, and may serve as a warning when thick weather obscures the shoreline in the vicinity.

Cortes Shoal.—This shoal stretches about seventeen miles from latitude 32 degrees 24 N., longitude 118 degrees 59½ W., to latitude 32 degrees 32 N., longitude 119 degrees 17½ W., but curves slightly to the southwest; within the fifty-fathom curve, the general trend is parallel with the islands of Santa Catalina, Santa Clemente, and San Nicolas. It has an average and nearly uniform width of three and a half miles. The nature of the bottom is hard, composed of white sand, broken shells, and fine coral at the south-east portion, and sand with broken shells at the north-west. The shoalest and most dangerous part is that known as the Bishop Rock, lying five miles from the south-east tail of the bank, and having but two and a half fathoms of water upon it. Around this danger the depth increases gradually, and in an extent of two and a half miles, in the general direction of the bank, reaches but fifteen fathoms. The position of these rocks is (approximately) latitude 35 degrees 25¾ N., longitude 119 degrees 05 W. From the north-west end of the island of San Nicolas the rock bears SE. ½ S., distant fifty-seven miles; and from the south-east end of the island of San Clemente it bears SW. ¼ S., distant forty-six miles. From the Bishop Rock to the west end of San Miguel Island the course is NW. ¼ W., and distant one hundred and fifteen miles.

New Hope Rock.—A pinnacle rock ten or twelve feet under water, breaking in a moderate westerly swell; bears due northwest (magnetic) from Point Loma light-house; it is one-half a mile from shore, and inside the line of the kelp. Reported by Capt. P. W. Packard, Pilot of San Diego Harbor.

San Geronimo Island.—The position of this island, as determined by the U. S. C. S., is latitude 29 degrees, 47 minutes, 13 seconds N.; longitude 115 degrees, 47 minutes, 52 seconds W.

Sacramento Reef.—This danger lies SE. ½ S. (magnetic) from San Geronimo Island, distant 6 miles; it is entirely surrounded with kelp.

San Martin's Island.—The position of this island, as determined by the U. S. C. S., is latitude 30 degrees 28 minutes 52 seconds N.; longitude 116 degrees 06 minutes 37 seconds W.

Ben's Rock.—This danger lies due south, (magnetic) distant three miles, from San Martin's Island; it is about 500 yards in diameter, varying in depth from 1½ to 10 fathoms.

The Cordell Bank, off Point Reyes, Cal.

The following information is published by authority of Professor Benjamin Pierce, Superintendent U. S. Coast Survey:

The middle of this bank lies 20 miles W. 20 degrees S. (compass) from Point Reyes light, and 28 miles N. 64 degrees W. from the South Farallon light, which shows just above the horizon. Table Mountain Peak is open one-quarter point south of Point Reyes.

Within the 50 fathom curve the bank is eight miles long NNW. and SSE. with an average width of $2\frac{1}{4}$ miles. There is a depth of 25 fathoms in several places upon it, but a minute examination may develop less. Within the 30 fathom line the bottom is rocky, and marked by live barnacles, and reddish tubular forms with red slime inside; between 30 and 40 fathoms finely broken white shells were found; and beyond 40 fathoms the bottom is composed of coarse black sand, with gravel and broken shells. Seals, sea-lions, marine birds, and schools of whales were found over the bank.

To the westward the depth increases very rapidly, reaching 270 fathoms within $1\frac{1}{2}$ miles; to the southward 275 fathoms in $4\frac{1}{2}$ miles; to the northward it has not been fully developed; to the eastward the depth increases gradually to 66 fathoms in seven miles, and then decreases to Point Reyes. The currents on the banks are irregular and weak.

Should the South Farallon and Point Reyes be obscured by low fog or haze, the following compass bearings will locate it: Table Mountain Peak N. 81 degrees E.; Ross Mountain 10 degrees E.

The examinations of this bank were made by Assistant Cordell, and by F. Westdahl, aid in Assistant Bradford's party.

Dangers off Cape Mendocino.

LOCATED BY ASSISTANT GERSHOM BRADFORD, U. S. C. S.

The bearings and distances are from the light-house.

I. The "Great Break," a rock, having 25 feet of water upon it, S. 68 degrees W., (compass) three miles distant; from the south rock of Blunt's Reef it bears S. 5 degrees E., distant $\frac{3}{4}$ of a mile. It breaks very seldom; 15 to 20 fathoms around it.

II. A rock having 11 feet of water upon it, S. 72 degrees W., $2\frac{3}{4}$ miles distant; from the south rock of Blunt's Reef it bears S. 30 degrees E., distant $\frac{1}{2}$ of a mile.

III. Heavy ground breaks, over an area of a quarter of a mile, in 9 and 10 fathoms, S. 77 degrees W., 2 miles distant.

IV. A rock having a quick, sharp and well-defined breaker, S. 52 degrees W., $1\frac{3}{4}$ miles distant. Not yet sounded upon; has fifteen fathoms alongside of it.

V. A rock having seven feet upon it, S. 25 degrees W., one mile distant; a sharp breaker has been located just outside of it, and just inside of it the top of a rock was seen in the trough of a heavy swell. Has 12 fathoms outside of it.

VI. A ledge, several hundred yards in extent, having 12 feet upon it, S. 7 degrees W., distant 1½ miles; has 12 fathoms outside it.

VII. A rock having 13 feet of water upon it, S. 75 degrees W., distant 1⅛ miles; it has 13 fathoms around it. One-quarter of a mile inside of it there is a distinct, well-defined breaker; and three-eighths of a mile inside was seen the top of a rock in the trough of the sea.

VIII. A rock, not yet sounded upon, N. 82 degrees W., distant one mile; it gives a sharp, well-defined breaker; another rock lies about a quarter of a mile north-east of this. The first has 11 fathoms alongside of it.

IX. A rock having 22 feet upon it, N. 66 degrees W., distant 1⅝ miles; it has nine fathoms around it. To the southward of this rock, over an area of three-eighths of a mile, three heavy ground-breaks were seen in 8½ to 10 fathoms water.

X. A rock having 12 feet of water upon it, W. ½ S., distant six-tenths of a mile from the Cape Rock, lying off Cape Fortunas; it has 13 fathoms of water around it.

These dangers show that the passage between Blunt's Reef and Cape Mendocino should be avoided; sunken rocks extend nearly a mile off the coast, from Shelter Cove to Cape Mendocino, and vessels should not approach it too closely.

The South Rock of Blunt's Reef bears S. 82 degrees W., distant 2 9-10 miles from the light-house.

GEO. DAVIDSON,
Asst. U. S. Coast Survey.

Feb. 17th, 1873.

Sunken Rock off Cape Mendocino, Cal.—Inside of Blunt's Reef is a sunken rock with six feet on it at mean low water; no kelp about it, and its summit is only from two to three feet in diameter; soundings around it deepening rapidly to nine and fifteen fathoms on all sides. Lies one and seven-tenths miles SW. ¾ W. (magnetic) from the light-house on Cape Mendocino. The ranges are: The center of the southern slope of Sugar-loaf Rock (half-way between summit and base) on with the light-house, and the point of land at Centerville showing half-way between a small rock inside of False Cape Rock and the point of land at False Cape, which latter is on with the outer edge of woods on the point of land at Centerville. Navigation between Blunt's Reef and Cape Mendocino is extremely hazardous; vessels bound around the cape should pass two miles to the westward of Blunt's Reef.

Located by Capt. Bradford, U. S. C. S., May, 1875.

Cape Fortuna (False Mendocino).—Off this cape there is a rock with 12 feet of water, bearing W. ½ S. from the Cape Rock, and distant six-tenths of a mile.

Chase Ledge.—A rocky ledge, several hundred yards in extent, not well marked by kelp, and has four fathoms water upon it at mean low water, with a depth of from 13 to 15 fathoms around it. It lies about 1¾ miles off shore, directly in the course of steamers to and from the southward of Crescent City, and in heavy south-east weather must break. The following magnetic bearings and distances are given to locate it: From Crescent City light it bears S. 40 degrees E., 1 7-10 miles. From Round Rock (45 feet high) S. 25 degrees E., between 8 and 9-10 of a mile. From Mussel Rock (7 feet high) S. 17 degrees W., 7-10 of a mile. Named from A. W. Chase, Sub-Assistant U. S. C. S., who discovered it.

Fauntleroy Rock, Harbor of Crescent City.—A day beacon has been erected on this rock; it consists of a wrought iron spindle painted red, and sunk into the rock, surmounted by a round iron cage painted red. Height above the rock, 25 feet.

Pass in on either side of Round Rock, within 50 yards on either side, then run directly for Fauntleroy Rock, and pass close to it, leaving it on the port side, then haul up and anchor, with Flat Rock on line with Battery Point. Kelp almost always marks the dangerous places. There is a sharp pinnacle rock 540 feet due east of Fauntleroy Rock, with only two feet of water upon it at low water. This is a dangerous place for strangers to enter without a pilot.

Sunken Rock off the Coast, south of Crescent City.—This danger lies nearly one mile off the point near Wilson's Creek, 9¾ miles southward of Crescent City light.

The top is circular, and about four feet in diameter, with only three feet upon it at low water, and within two boats' lengths around it the depth is 15½ fathoms. The sea rarely breaks upon it, and it cannot be otherwise distinguished at a ship's length. There is no kelp to mark it. From it we have the following compass bearings and distances:

Sister Rocks, NW. by N., four miles.

Far Island, E. by N., ½ mile.

The Sister Rocks lay half a mile off the coast, about 5¾ miles southward of Crescent City light.

Dangers on the Coast between Shelter Cove and Cape Mendocino, Cal.

Sunken rocks, extending in some cases nearly one mile off shore, and occupying the greater part of the passage between Blunt's Reef and

Cape Mendocino, were discovered by Assistants George Davidson and Aug. F. Rodgers, U. S. C. S. Upon some of these rocks the sea breaks only occasionally, with a heavy swell on at low water, and can rarely be detected when strong winds are blowing. Their positions are not yet all accurately determined; but a vessel cannot safely approach the above line of coast within less than a mile and a half, or Blunt's Reef within a mile.

Sunken Rocks in Chetko Anchorage, Oregon.—A sunken rock, 12 feet long by 6 feet wide on top, and having 15 feet of water upon it at low water, has been discovered and located by Lieut. Comdr. H. C. Taylor, U. S. N., in command of the U. S. C. S. steamer "Hassler." Close around it the depth is five fathoms. Thin kelp grows upon it, but not sufficiently dense to be readily noticed.

It lies S. by E. $\frac{1}{2}$ E. by compass, distant 700 yards from the large white house on the west point of the mouth of Chetko River. Vessels seeking anchorage here should keep the house always northerly of a N. by W. bearing, and anchor in $6\frac{1}{2}$ fathoms, sandy bottom, with the inner or northerly rock above water bearing N., distant 370 yards, and the southwest rock bearing NW. by N., distant 130 yards. In this position the white house is open to the west of the inner or north rock, and the sunken rock described bears NE. by N., distant 175 yards. The two other sunken rocks upon which the sea breaks, and hitherto known, lie respectively S. 30 degrees E., distant three-quarters of a mile, and S. 30 degrees E., one half mile, from the white house.

Mack's Shelter, Oregon, is in latitude 42 degrees, 14 minutes, 30 seconds N.; longitude 124 degrees, 24 minutes 30 seconds W.; 14 miles to the northward of Chetko Cove, and is distinguishable upon almost any approach by Mack's Reef, lying off Mack's Point. This reef consists of a line of rocks, the most prominent of which range from 100 to over 200 feet in height; the highest, called Mack's Arch, being at the southern extremity, and unmistakable from the large opening through it.

The course in for the anchorage, with Mack's Arch on any bearing from NW. by N. to E. $\frac{3}{4}$ N., leads to 350 yards distance from the arch, carrying not less than fifteen fathoms of water; when it changes to pass to the eastward, not nearer than fifty yards, and then leads along the line of the reef in the direction of the inner or northern end, where it appears to join the shore.

With Mack's Arch bearing S. by E. $\frac{1}{4}$ E., and Mack's Point NNE. $\frac{1}{2}$ E., a good anchorage is had from 300 to 400 yards off the reef, in six and a half fathoms of water, sandy bottom. Inside of this is an inner anchorage, separated from the outer by a thick belt of kelp, stretch-

ing from the beach to the reef, but through which there is a clear channel.

With the highest point of Mack's Arch bearing S. ¾ E., the course for entering is N. ¾ W., leading through the channel in from three and a half to four fathoms water, and avoiding a *sunken rock*, with only two feet on it at low water, which lies at the edge of the kelp on the eastern side. From the northern or inner end of the channel, the course leads to the westward, and good anchorage is had just inside the kelp, in from four to five fathoms of water, sandy bottom—Mack's Point bearing E. ¾ N., and Mack's Arch S. by E. ½ E.

There are passages between the rocks, leading in to the inner and outer anchorages, apparently free from danger; but it is recommended that they should not be used until they are closely surveyed.

Wood and water can be obtained here, but no other supplies.

Sunken Rocks on Patridge Bank, Fuca Strait.—Reported by James S. Lawson, U. S. C. S. Within the ten-fathom curve the bank is three miles long, and ENE. 1½ mile wide, and the eastern extremity reaches within two miles of Point Patridge. The north and east sides fall off sharply to twenty fathoms. A considerable part of the bank is covered with kelp, which is much under-run by strong currents. The kelp generally extends to the seven-fathom curve, except toward the eastern end, where none exists beyond a depth of four fathoms. The currents over the bank are irregular, except under the eastern extremity, where they set strongly from the north and northwest at flood and ebb tides. The bottom is generally sand, gravel, and bowlders, except near the shoalest spot, where it is rocky and thickly covered with kelp; has a depth of only 14 feet at the lowest water, and is distant 3 4-10 miles from the nearest shore of Whidby Island. The following magnetic bearings and distances are given to locate the danger: From Smith's Island light-house it bears SSE., distant 3 8-10 miles; from Admiralty Head light-house it bears W. by N. ¾ N., distant 8 7-10 miles; from Point Wilson it bears NW. ½ W. distant 7 3-10 miles; from New Dungeness light-house it bears NE., distant 11 5-10 miles.

NOTE, ED.—A buoy has since been anchored in 20 feet of water, 66 yards S. 25½ degrees E. of the 14-feet rock.

Strait of Juan de Fuca.—A patch of kelp is found one mile south of the south-eastern point of Bellevue or San Juan Island, and eight and a half miles NW. by W. one quarter W. from Smith's Island, with three fathoms marked on it; but it is reported that H. B. Co's steamer "Otter" found only six feet.

Bearing W. half S. from Smith's Island, and eight miles distant, is another field of kelp, nearly a mile in extent, having five fathoms throughout it.

Rock in Roche Harbor, Haro Strait.—SCOUT PATCH.—This dangerous rock, which narrows considerably the northern passage into Roche Harbor, lies in the centre of the channel westward of Pearl Island. It is half a cable long, with 17 feet at low water springs, and bears from the centre of Neck Islet (which is connected by a narrow sand-spit to the western end of Pearl Island) SW. $\frac{3}{4}$ W., distant one and three-fourths cables. A narrow five-fathom channel at low water exists on the eastern side of the patch.

Bearings (magnetic); Variations 22 degrees E. in 1869.

Unit Rock in the Canal de Haro.—When eight and a half miles within the south entrance of the strait, the width decreases to three and a half miles, having Darcy Island on the west; off its NE. face lies a small islet, and off the SE. face lie very large fields of kelp, stretching far off to the south-east; in 1863, in one of these fields, was discovered a sharp pointed rock, called Unit Rock, lying E. by S. $\frac{5}{8}$ S. (magnetic) from the SE. part of the island, and distant three-quarters of a mile; the sharp apex of this rock was about three feet above water at the very lowest tides.

Since this discovery, several rocks, covering a space of half a mile square, on the same bearing from the south-east point of Darcy Island, have been found. They are marked by a field of kelp, and one point uncovers at the lowest tides. Near mid-channel a depth of 155 fathoms is found.

Lawson Reef.—This ledge lies at the south-eastern part of the southern entrance of Rosario Strait, Washington Sound, and directly off the western entrance to Deception Pass. Its general direction is north and south, (by compass) and within the eight-fathom curve is six-tenths of a mile in length and three-tenths of a mile in breadth. The kelp patch marking it is half a mile long north and south, and lies over the part of the reef having six fathoms of water and less. The shoalest part is about 170 yards in extent, and has three and three-quarters fathoms over it at mean low water.

The depth of water increases very rapidly away from the reef, but more particularly on the north-east side, where a depth of thirty fathoms is found within 200 yards of the ten-fathom curve. On the west side the thirty-fathom curve lies a quarter of a mile from the ten-fathom curve. Within half a mile from the ledge on the east and south sides, the depth of water is fifty fathoms.

The following compass bearings and distances locate the shoalest part, which is about the middle of the ledge. Deception Island bears N. 59 degrees E., distant 1.75 miles. Burrows Island, just open by Allan Island, N. 22 degrees W., distant 4.5 miles. Eastern point of Wat-

mough Head, S. 85 degrees W., distant 4.0 miles. Smith's Island light-house, S. 23 degrees W., distant 7.3 miles. Point Patridge, S. 10 degrees E., distant 10.5 miles. This reef has been named from James S. Lawson, U. S. C. S.

Portlock Bank.—Latitude 58 degrees 16 minutes N., longitude 149 degrees 42 minutes W. This extensive bank was located in the given position by the U. S. Coast Survey in 1867; it is about 100 miles ENE. easterly (true) from St. Paul's, Kodiak Island. The shoalest water, found on a single line of soundings only, was forty-five fathoms in the above position; bottom, black sand, pebbles, and mud. Detailed examinations are necessary to give the limits of this bank, which is believed, by soundings given by Portlock, Cook, and others, to be very extensive.

Ounimak Bank.—Latitude 53 degrees 35 minutes to 53 degrees 40 minutes N.; longitude 164 degrees 10 minutes to 164 degrees 30 minutes W. The extent of this rich COD BANK, lying eastward of Ounalaska Island, is not known. Soundings in fifty and sixty-five fathoms were obtained upon it by the U. S. Coast Survey in 1867, in thick weather, with approximate positions as above given, being sixty-five miles ESE. (true) from the middle of Akoutan Passage, and forty miles SSE. (true) from the Ounimak Passage; bottom black and white sand, with pebbles.

Suwanee Rock.—This rock, on which the U. S. ship "Suwanee" was wrecked in July, 1868, lies in Shadwell Passage, about 150 feet from Hope Island. It is nearly awash at low water, and is not laid down on the latest Admiralty charts. In entering this passage from the Goleta Channel, give a good berth to the point of Hope Island, (as the rock lies a little to the northwest of a line drawn from this point to the nearest point of Vansittart Island) then round into Shadwell Passage with eight fathoms water, gradually deepening to twelve fathoms, when abreast of Lone Tree Island. Unless well acquainted with this locality, or under charge of a competent pilot, it is not recommended for ships to use this passage; Bates Passage, to the southward and eastward of Vansittart Island, is a deep, clear channel, and the distance is very little greater.

The Following Notices

Are arranged in the order of their latitudes, commencing at the most northern ones, and proceeding south:

Shoal in the Bay of Anadir, latitude 64 degrees 15 N.; longitude 178 degrees 00 W. Is about two miles in extent, and only eight feet of water upon it.

Island.—Latitude 59 degrees 26 N.; longitude 146 degrees 05 W. Ten miles long and five miles wide; not laid down on charts. Reported by Captain Freeman, U. S. steamer "Newbern."

Rock near Jonas Island, sea of Okhotsk; latitude 56 degrees 27 N.; longitude 143 degrees 14 E. Is about 1½ miles NW. by N. from the island, with but six inches of water upon it; deep soundings around it.

Barrack Rock, Gulf of Tartary.—Latitude 45 degrees 42 N.; longitude 140 degrees 42 E. Twelve miles west of Rifunsiri.

Reef in latitude 44 degrees 23 N.; longitude 152 degrees 53 W.

Island in latitude 41 degrees, 54 minutes, 30 seconds N.; longitude 133 degrees, 46 minutes, 50 seconds E.

Breaker in latitude 37 degrees 50 minutes N.; longitude 128 degrees 22 minutes W. Reported by Capt. Peterson, of the schooner "Ada May." The sea was smooth and a heavy swell from the west, met by an easterly wind, caused a heavy breaker, indicating shoal water. His chronometer was correct on reaching San Francisco, December 20th, 1876.

Reed or Falmouth Rocks.—Latitude 37 degrees 28 N.; longitude 137 degrees 28 W. These rocks reported in former editions of this Almanac as separate dangers, have since been assumed to be identical, with the probable position as given above.

NOTE.—Extract from Maury's Sailing Directions, 8th vol. "A green strip of water is often seen by captains of packets a couple of hundred miles off the coast of California, which, on appoaching the coast, they cross, again entering dark blue water before making the green water of the coast soundings. Capt. Elias Hempstead informs me that he can depend upon it as much as on the Gulf Stream in the Atlantic."

NOTE TO ABOVE, ED.—Capt. Gibbs, of the ship "Two Brothers," informs me that the above green strip of water where he crossed it was seventy-five miles wide; he entered upon it suddenly, and left in the same manner.

Shoal.—Latitude 35 degrees 30 N.; longitude 155 degrees 17 E. Reported by Captain Warsaw, of the P. M. steamer "Colorado." He found 80 fathoms on the southern edge of it.

Elmstone Rock.—Latitude 35 degrees 13 minutes N.; longitude 139 degrees 43 minutes E. In the Uraga Channel, leading into Yedo Bay, with ten feet over it at low water, more than 300 feet in extent, with kelp near the surface. From the shoalest part, the east extreme of Cape Kami-saki bears N. by E. ½ E., the south extremity of the northern shore of Uraga Cove W. ½ N., and the Plymouth Rocks S. by W. To avoid it, do not bring Cape Kami-saki eastward of N. ½ E., or the Plymouth Rocks southward of S. by W. ¾ W.

Rock in the Straits of Simonosaki, Nipon.—Latitude 34 degrees 28 minutes N.; longitude 131 degrees 0 minutes 51 seconds E. Is sixty fathoms long, north-west and south-east, with four feet of water over it on the southern, and two fathoms on its northern extremity, with five fathoms between both extremities at low spring tides, and deep water close to. From the rock, Moze-saki bears S. 62 deg. W., Isaki S. 68 deg. E., Kusi-saki N. 35 deg. E., and the south point of Manziu N. 61 deg. E. It is a late discovery.

Powhattan Reef.—Latitude 30 deg. 42 min. N,; longitude 130 deg. 20 min. E. Reef of rocks about one mile in extent. From the center rock the south-west point of Volcano Island bears NW., the east point of the same N. $\frac{1}{2}$ W., and the east point of Fakesima, or Apollos, NE. $\frac{1}{2}$ N.

Mariners' Hope Reef.—Latitude 30 deg. 25 min. N.; longitude 122 deg. 5 min. E. The "Mariners' Hope" struck on a reef between Fisherman's Group and Chusan Islands, which was found to be one-third of a mile long, east and west, and two cables' length broad. From the ship, which had seven fathoms under her bow, and only five feet astern, the southern extremity of Chusan bore E. $\frac{3}{4}$ S., large volcano SW., westerly, the Rugged Islands from NNW. $\frac{1}{4}$ W. to NNE. $\frac{1}{2}$ E., and Skead Island S. $\frac{3}{4}$ E., distant three miles. Subsequently, the Hamburg bark "Emerald" was lost on a rock about three miles S. $\frac{1}{2}$ E. from Skead Island, confirming the above.

Arabia Shoal.—Latitude 29 deg. 30 min. N.; longitude 155 deg. 55 min. W., extending SSE. and NNW. two miles, by one mile in breadth, the lead giving eleven fathoms.

Island.—Latitude 28 deg. 35 min. N.; longitude 171 deg. 42 min. W.

Middlebrook Island and Reef.—Latitude 28 deg. 16 min. N.; longitude 177 deg. 12 min. W.

Reef on the Coast of Lower California.—Latitude 27 deg. 52 min. N.; longitude 115 deg. 05 min. W. The "Emerald" touched on a reef between Natividad Island and Point Eugene, one mile to the eastward of Seal Rock.

Shoal.—Latitude 27 deg. 40 min. N.; longitude 140 deg. 49 min. W.

Bank.—Latitude 25 deg. 43 min. N. to 26 deg. 3 min. N.; longitude 173 deg. 30 min. W. The brig "Delaware" reports a bank extending north-west and south-east about thirty miles, apparently very shoal. The U. S. surveying schooner "Fenimore Cooper" found bottom, at from fifteen to forty fathoms, between the parallels 25 deg. 43 min. N. and 26 deg. 3 min. N., and the meridians of 173 deg. 29 min. W. and 173 deg. 32 min. W.; both reports confirm the existence of this bank.

Passion Island.—Latitude 25 deg. 48 min. N.; longitude 136 deg. 36 min. W. Whalers' report.

Boxer Rock, Amoy Harbor.—Latitude 24 deg. 28 min. 5 sec. N.; longitude 118 deg. 2 min. 36 sec. E. In the fairway of the western entrance into Amoy Harbor, with twelve feet of water on it. From it Hanson Island bears N. 39 deg. W.; Kulanguson Island, north-west point, S 21 deg. W., north point, S. 11 deg. E.; Dock Island, S. 78 deg. E., and nearly in line with the church.

Roebur Rocks.—Latitude 24 deg. 09 min. N.; longitude 122 deg. 23 min. E. The ship "Roebur" reports in this position a group of rocks sixty feet high, perpendicular on all sides, broken in two or three places, the ledge about 300 feet long. Half an hour after losing sight of them, Koumi Island was made.

Oriental Bank.—Latitude 23 deg. 58 min. 54 sec. N.; longitude 122 deg. 40 min. 30 sec. E. The "Oriental" reports passing within two cables' length of a round sand-bank of three cables' diameter, on which the sea broke violently. Her chronometer had been corrected by Agincourt Island.

Breakers.—Latitude 23 deg. 47 min. 50 sec. N.; longitude 120 deg. 2 min. 30 sec. E. Captain Richer reports a very extensive line of breakers, on which the sea broke furiously, in the middle of the passage between Pescadores Islands and the west coast of Formosa.

Shoal.—Latitude 23 deg. 45 min. N.; longitude 163 deg. 30 min. W. Ship "E. L. Frost" reports a shoal less than 100 miles WNW. from Bird Island, with seventeen and twenty fathoms of water on it, coral bottom, and upwards of fifty miles in extent from north to south.

Hesper Rock, Coast China.—Latitude 23 deg. 20 min. 30 sec. N.; longitude 117 deg. 7 min. E. A rock with ten feet of water on it, Plat Island bearing S. 73 deg. W.; Dome Island N. 52 deg. E.; Three Chimney Bluff N. 12 deg. E.

Thomson's Reef.—Latitude 14 deg. 40 min. N.; longitude 122 deg 6 min. W. Reported by Captain Thomson of ship "Glad Tidings," as being about forty feet long, and eight or ten feet high, with a sharp pinnacle in the middle; color a reddish brown; plenty of birds around.

Montafur Shoal.—Latitude 13 deg. 7 min. N.; longitude 124 deg. 7 min. E. The ship "Manly" was wrecked on this shoal, which is said to be four miles from shore.

Condor Reef.—Latitude 10 deg. 42 min. N.; longitude 102 deg. 48 min. E. This position is assumed as a mean of several reports of this danger, on which two or three vessels have been lost.

Julia Shoal.—Latitude 9 deg. 56 min. N.; longitude 109 deg. 9 min. E. This shoal, only lately established, is a small coral patch about a quarter of a mile in extent, with two and a half fathoms at low water, SE. by E. three and a half miles from Pulo Sapata. Pyramid Rock,

in line with the right extremity of Pulo Sapata, clear it to the north-east.

Shoal.—Latitude 9 deg. 29 min. N.; longitude 121 deg. 20 min. E. The ship "Cito" struck on this shoal and was lost four or six miles south of Cagayanoillo.

Reef.—Latitude 6 deg. 27 min. 30 sec. N.; longitude 162 deg. 21 min. W. This position is given as the mean of several reports of this danger, which is described as composed of coral and sand, and when the breakers on the north-east part bear east, with a moderate wind, a few spots of sand or coral can be seen above water. The northern part runs ESE. and WNW., twelve miles. Shoal water extends several miles to the southward. The steamer "Tartar" struck on this reef.

Shoal.—Latitude 3 deg. 53 min. N.; longitude 166 deg. 06 min. W.; $3\frac{3}{4}$ miles long. WNW. and ESE., one-eighth mile wide; had apparently about six feet water on it; no soundings taken.

Fanning Island.—Latitude 3 deg. 49 min. N.; longitude 159 deg. 20 min. W. This is assumed to be the correct position of this island, being a mean from eight different reports.

Howland Island.—Latitude 0 deg. 50 min. N.; longitude 176 deg. 35 min. W. This is assumed to be the correct position, deduced from eight different reports.

Baker Island.—Latitude 0 deg. 15 min. N.; longitude 176 deg. 22 min. W. This is assumed to be the correct position, deduced from seven different reports.

SOUTH PACIFIC OCEAN.

Jarvis Island.—Latitude 0 deg. 22 min. 4 sec. S.; longitude 159 deg. 53 min. W. This is assumed to be the correct position, deduced from four different reports.

Drummond Island, with Nautilus Shoal.—Latitude 0 deg. 30 min. S.; longitude 174 deg. 20 min. E. This island is the Nanouti or Sydenham Island of most charts. The Nautilus Shoal is the coral bank with nine fathoms water over it, extending from the north-west point of the island one and a half miles beyond the reef which makes out from this point.

Rock in Gardiner Bay, Galapagos Island.—Latitude 1 deg. 22 min. S.; longitude 89 deg. 44 min. W. A rock has been discovered in the center of Gardiner Bay of about thirty feet in length NW. to SE., and ten feet broad, with thirteen and a half feet water over it, and seven and a half fathoms close to. From it the outer end of the island lying in the east part of the bay bears S. 70 deg. E., two-thirds of a mile dis-

tant; a small island in the south-west part of the bay, S. 50 deg. W., one-half a mile; the center of Gardiner Island N. 61 deg. E. half a mile; and the extreme west end of the bay, W. one mile distant.

Reef.—Latitude 1 deg. 31 min. S.; longitude 175 deg. 35 min. W.

Shoal in Banca Strait.—Latitude 2 deg. 34 min. S.; longitude 105 deg. 48 min. E. Mud-bank with four fathoms water on it, Nangka Island bearing N., and the middle of Mount Parmassang E.

Phœnix Group.—

Mary's Island.....Lat.	2 deg. 41 min. S.;	Long. 171 deg. 40 min. W.
Enderbury's Island. "	3 deg. 08 min. S.;	" 171 deg. 08 min. W.
Birnie's Island..... "	3 deg. 34 min. S.;	" 171 deg. 33 min. W.
Phœnix Island..... "	3 deg. 42 min. S.;	" 170 deg. 40 min. W.
McKean's Island... "	3 deg. 35 min. S.;	" 174 deg. 17 min. W.
Sidney Island ..... "	4 deg. 30 min. S.;	" 171 deg. 30 min. W.
Hall's Island..... "	4 deg. 30 min. S.;	" 172 deg. 20 min. W.
Gardiner's Island.. "	4 deg. 37 min. S.;	" 174 deg. 40 min. W.

Island.—Latitude 3 deg. 55 min. S.; longitude 170 deg. 15 min. W. Reported by ship "Corinthian," as extending E. by S. and W. by N. fifteen miles, three miles broad, with only a small part above water.

Starbuck Island, west point.—Latitude 5 deg. 37 min. S.; longitude 155 deg. 56 min. W.

Shoal in Sunda Strait.—Latitude 6 deg. 38 min. 30 sec. S.; longitude 105 deg. 23 min. 45 sec. E. Welcome Bay, on the southern shore of Sunda Strait, appears full of dangers. A shoal with twelve feet on it, and six fathoms close to, extends between Second Point and Tambiang Point to the distance of half a mile off shore.

Garcia Rock in Malabrigo Road, Coast of Peru.—This rock is the shoalest part of a rocky patch, about two cables in extent, consisting of pinnacles with sand between. The least water found was twelve feet, with fourteen and eighteen on other parts of the shoal. The Garcia Rock of twelve feet is a little more than half a mile from the shore, with the extremity of Malabrigo Point SW. $\frac{1}{2}$ S., Observation Point (which may be known by the black rocks off it) S. by W., and a white cross westward of the village SE. $\frac{1}{4}$ E. Vessels may anchor in Malabrigo Road in four fathoms, with the center of the village ESE., distant about three-quarters of a mile, and avoiding the above rocky ground by Observation Point not being brought to bear eastward of S. $\frac{1}{4}$ E. Variation in 1869, 10 deg. 22 min. E.

Thomaset Rock.—Latitude 10 deg. 21 min. S.; longitude 138 deg. 29 min. W. It is fifteen and a half miles E. by N. from the northwest point of Magdalena Island, (the south-easternmost of the Marquesas) and is ten feet under water.

Neptune Reef.—Latitude 12 deg. 54 min. S.; longitude 161 deg. 45 min. W. This reef, on which the ship "Neptune" struck, is described as being sixteen to eighteen miles long, by about seven wide, forming a deep lagoon. The only raised portion of the reef visible from the ship's topmast-head was a rock, about six feet high, near the center of the eastern side.

Island.—Latitude 13 deg. 0 min. S.; longitude 160 deg. 0 min. W.

Shoal off Point Venus, Tahiti.—Latitude 17 deg. 29 min. S.; longitude 149 deg. 33 min. W. Seen by the French ship "St. Clair"; has eighteen feet of water on it. Point Venus bearing E. by S. by compass, distant four and a half miles; would be nearly two miles outside of the Dauphin Bank, the westernmost danger reported on French authority.

Island.—Latitude 19 deg. 24 min. S.; longitude 139 deg. 24 min. W. Reported to exist ten miles west of Egmont Island.

Miller Reef.—Latitude 20 deg. 51 min. S.; longitude 158 deg. 02 min. E. This reef, on which the bark "Henry Miller" struck in December, 1868, was found to be in the above position from observations taken on the reef, and appeared to extend about two miles in a north-west and south-east direction, and to be about one cable in width. A rise and fall of eighteen inches at neaps was observed, as also a slight set to the north-west.

Reef.—Latitude 21 deg. 43 min. S.; longitude 176 deg. 42 min. W. H. B. M. ship "Pelorus" sounded in this position at night and found six and a half and seven fathoms.

Reef.—Latitude 22 deg. 47 min. S.; longitude 151 deg. 07 min. W. The bark "Henry" is reported to have been lost on a coral reef in this position, over which there is only eleven feet of water.

La Brilliante Shoal.—Latitude 23 deg. 13 min. 52 sec. S.; longitude 170 deg. 4 min. E. This dangerous reef, described as a round patch of coral about one-quarter of a cable in diameter, with one or one and a half fathoms of water over it, was removed from the charts after an unsuccessful search for it in 1853, but has since been seen from the ship "Creole." Two soundings, in twenty and twenty-three fathoms, were obtained in its vicinity.

Rock near Bolivia.—Latitude 23 deg. 23 min. S.; longitude 70 deg. 42 min. 39 sec. W. This is a new discovery, has nine feet of water over it, is one and three-quarters miles west of the Lagortos Reef, south of the Mexillones Bay, the Morro de Mexillones bearing from it N. 11 deg. E. by compass, and Moreno S. 32 deg. E. From seven and a half to twelve fathoms were sounded in the channel between it and the Lagortos.

Oend Island.—Latitude 24 deg. 1 min. 30 sec. S. (north end); longitude 130 deg. 41 min. W. Dangerous, uncovered at low tide. The position given was determined by Captain Beechey, H. B. M. Navy.

Rock.—Latitude 26 deg. 0 min. S.; longitude 106 deg. 28 min. W., standing four feet awash. Reported by ship "Minnehaha."

Haymet Rocks.—Latitude 27 deg. 11 min. S.; longitude 160 deg. 13 min. W. The cutter "Will Watch" passed between two rocks about a quarter of a mile distant from each other, with apparently seven or eight feet of water over them, and struck on the northern one.

Island off the Coast of Chili.—Latitude 31 deg. 40 min. S.; longitude 73 deg. 25 min. W. Reported by ship "Tubal Cain" as being fifteen miles long, north and south, consisting of a white mass, one part 200 to 250 feet high, having on its northern side a peculiar peak, resembling a Spanish cap, turned to the southward.

Houghton Reef.—Latitude 31 deg. 40 min. S.; longitude 154 deg. 28 min E. Has eight or ten feet of water over it, breaking heavily, and extending three-quarters of a mile from SE. to NW.

Curphy Bank.—Latitude 31 deg. 48 min. 30 sec. S.; longitude 152 deg. 48 min. E. The sea seldom breaks on this bank. It lies NNE. $\frac{1}{2}$ E., distant three miles from Crawdy Head, and has five fathoms of water over its shoalest part, with thirteen fathoms inside.

Rock, Coast Chili.—Latitude 32 deg. 22 min. S.; longitude 71 deg. 31 min. W. Reported by mail steamer "Bogota" as a sunken rock, on which the sea breaks occasionally, lying two miles WSW. of Cruz de la Balena Point, about forty-two miles northward of Valparaiso. (Var. 16 deg. E. in 1864.)

Mas-a-Fuera Island.—Latitude 33 deg. 40 min. S.; longitude 80 deg. 56 min. 30 sec. W. Authorities have differed in regard to the exact position of this island. The one given was brought from the island in four days to Valparaiso by H. B. M. ship "Talbot," and can be relied on as correct.

Lightning Rock; Entrance to Port Philip Harbor.—Latitude 38 deg. 17 min. S.; longitude 144 deg. 38 min E. Two patches of sunken rock have been found outside of Point Nepean, in the entrance of Port Philip. They are nearly 170 feet apart, about NW. by W. and SE. by E. from each other; and a line passing through the tidal flag-staff and the Point Lonsdale red-ball beacon leads over the middle of both. The eastern patch is about fifteen fathoms in extent, with only twenty-nine feet of water over its shoalest part, and seven to eight fathoms close by. It is eight-tenths of a mile SW. by W. from the red beacon on Nepean Dry Rock, and about one and two-fifths miles SE. by E. from Point Lonsdale flag-staff. The western patch is about one-third larger than

the eastern, and is the most dangerous, being nearer the fairway, and having only sixteen feet water on the shoalest rock, which rises abruptly in eight fathoms. At about twenty fathoms to the southward of it there is another rock, with only twenty-four feet over it. The western patch lies about nine-tenths of a mile WSW. from the red beacon on Nepean Dry Rock, and about one and one-tenth miles from the Lonsdale flag-staff.

To avoid these dangers, vessels going in or out should endeavor to keep to the westward of both. Keep the new light-house just open to the westward of the red obelisk on Shortland Bluff, until you open Point Lonsdale telegraph station well out to the northward of the tidal flag-staff when going in, and well out to the southward of the tidal flag-staff when going out. Bearings are magnetic, and depth at low water spring tides.

Rock, in Bass Strait.—Latitude 39 deg. 28 min. 30 sec. S.; longitude 146 deg. 43 min. E. The ship "Clarendon" struck upon a rock at half tide with apparently only ten feet of water over it; it proved to be round, and about forty or fifty feet in circumference. The highest part of Curtis Island bore W. by S. when the ship struck, and the inner Sugar Loaf SW. by S., three miles distant.

Duke of York's Islands.—"On beating up along the west coast of Patagonia for the Straits of Magellan, the wind moderate, ship heading east, Duke of York's Islands in sight, and Conception Strait also traceable, an islet was observed from H. M. S. "Scout," with rocks above water south of it, the ship at the time being in latitude 50 deg. 47 min. 45 sec. S.; longitude 75 deg. 45 min. W., and the island bearing E. $\frac{1}{2}$ N., distant three and a half to four miles. The northern islet, or rock, seemed to be about ten feet high; bare, rugged, and nearly two hundred feet in length. The rocks south of it were nearly covered with broken water, but distinctly seen on a wave receding."

Rock, in Magellan Strait.—Latitude 50 deg. 47 min. S.; longitude 75 deg. 20 min. W. A rock above water with heavy breakers all around it, bearing nearly SE. from Cape St. Jago, (the south-west extremity of the Duke of York's Island) distant from it four or five miles.

Rock, in Magellan Strait.—Latitude 50 deg. 48 min. 30 sec. S.; longitude 74 deg. 14 min. W. Reported by Comdr. Shirley, U. S. S. "Suwanee," as a rock in Smyth Channel, near Cape Charles and in the given position, without kelp on it, but the ripple from the paddle made the water break. Its existence is confirmed by Capt. Bradbury, of the Am. Steamer "Colorado," who states that it may have one foot of water over it. To avoid it, keep well on the eastern shore, after passing Cape Charles, till the Quia Channel is open.

A Harbor of Refuge near Cape Horn.—Latitude 55 deg. 32 min. S.; longitude 67 deg. 35 min. W. The captain of the British bark "Cedric," of Liverpool, reports having discovered a splendid bay with safe anchorage in the Island of Wallaston, Hermit Group, south of Terra del Fuego, 29 miles from Cape Horn; it is fully protected from all winds and storms, and an abundance of wood and fresh water can be obtained.

Passing outside or inside of the Island of Ildefonso heading for False Cape Horn, and passing within two miles clear of it, steer N. $\frac{1}{4}$ W. by compass, which will bring the point of the island in view; eighteen miles further on the anchorage is reached in nine to twelve fathoms of water, with a good clear bottom.

NOTE.—A large portion of the above list of dangers are extracts from the "List of the reported dangers in the Pacific Ocean," issued by the Navy Department, Washington; a work which was compiled with great care and from every known authority by the Bureau of Navigation, and is undoubtedly correct. The selections made are such as were considered most essential for navigators bound to this port, and as many of them were entered as the limits of the Almanac would permit.

Hereafter, shipmasters will confer a favor by reporting to me such new dangers as they may discover, with their positions, as close as it may be possible to determine; and if of shoals, the depth of water shown by the lead. Verifications of doubtful dangers, heretofore reported, will be cheerfully received and entered in future editions.

THOMAS TENNENT.

PILOT REGULATIONS OF THE PORT OF SAN FRANCISCO.—Approved March 29th, 1878.

EXTRACTS.

All vessels, their tackle, apparel, and the furniture, and the master and owners thereof, are jointly and severally liable for pilotage fees, to be recovered in any Court of competent jurisdiction.—*Political Code*, page 443, Section 2432.

Every pilot, on boarding a vessel, when required by the master thereof, must exhibit his commission as pilot. A refusal so to do subjects him to a forfeiture of his commission or license, and a recovery of fifty dollars on his bond, in a suit instituted for that purpose by the authority appointing him.—*Political Code*, page 444, Section 2434.

Every pilot carried to sea against his will, or unnecessarily detained on board of a vessel, when a pilot boat is in attendance to receive him,

is entitled to receive the sum of eight dollars per day while necessarily absent or detained, not to exceed in the aggregate the sum of one thousand dollars in any one case, which sum may be recovered by an action against the master or owner of the vessel so taking him away.—*Political Code*, page 444, Section 2435.

Every pilot in charge of a vessel arriving in the port of San Francisco must safely moor the vessel in such position as the master of the vessel or Harbor Master may direct. He must prevent all persons, (except officers of the State or Federal Governments, owners or consignees of the vessels or cargo, and persons admitted on the express orders of the master) from boarding such vessel until she has been safely moored. To enforce the provisions of this section and other police regulations for the harbor of San Francisco, every pilot in charge of a vessel entering the harbor of San Francisco is authorized and empowered to arrest every one who, in opposition to the master's orders, persists in boarding such vessel, or who, having boarded her, refuses to leave on the command of such master or pilot; when so arrested, he must be immediately brought before the Police Judge's Court, or admitted to bail, as provided in the Penal Code.—*Political Code*, Vol. 1, page 449, Section 2459.

The pilotage inside the Heads to the anchorage opposite San Francisco, and about the harbor, or between the harbor of San Francisco and the ports of Mare Island, Vallejo, or Benicia, must be at such rates as agreed on between the parties, not to exceed five dollars per foot draught.—*Political Code*, page 452, Section 2465.

The following are the rates of pilotage into or out of the harbor of San Francisco: Vessels under five hundred tons, five dollars per foot draught; vessels over five hundred tons, five dollars per foot draught, and four cents per ton for each and every ton of registered measurement. Vessels engaged in the whaling or fishing trade shall be exempt from all pilotage except where a pilot is actually employed. When a vessel is spoken, inward or outward bound, and the services of a pilot are declined, one-half of the rates must be paid. In all cases where inward bound vessels are not spoken until inside of the bar, the rates of pilotage and one-half pilotage must be reduced fifty per cent.—*Political Code*, Vol. 1, page 452, Section 2466.

Any vessel in tow of a steam-tug between the harbor of San Francisco and the ports of Mare Island, Vallejo, or Benicia, is not liable for pilotage unless a pilot is actually employed.—*Political Code*, pp. 452, 453, Section 2467.

All vessels coasting between San Francisco and any port in Oregon, or in Washington or Alaska Territories, and all vessels coasting between ports of this State, are exempt from all charges of pilotage unless a pilot is actually employed.—*Political Code*, page 452, Section 2468.

If any pilot, in endeavoring to assist or relieve any vessel in distress, suffers loss or damage in his boats, sails, tackle, rigging, or appurtenances, the master, owner, or consignee of such vessel must pay the value of such loss or damage, to be ascertained by the Commissioners. (Section 2433.)

When cruising off or standing out to sea, pilots must go to a vessel nearest to shore, or in the most distress, under a penalty of one hundred dollars. For refusing to go on board a vessel when required, a like penalty may be imposed. (Section 2437.)

When two or more pilots shall offer their services to any vessel inward bound, the pilot first offering, or one connected with the same boat, shall have preference; and if the services of another be accepted, the vessel, her appurtenances, and the master and owner thereof shall be jointly and severally liable to the pilot entitled to such preference for one-half the amount of pilotage he would have been entitled to had his services been accepted. (Section 2469.)

Any pilot bringing a vessel into the harbor (or one connected with his boat) shall be entitled to take such vessel to sea again when she departs; *provided*, such pilot and those connected with his boat have not in the meantime become in any manner disqualified or incapacitated; and if such preference be disregarded by the master of such vessel, the vessel, master, and owner shall be liable to the pilot entitled to such preference for one-half the amount to which he would be entitled if his services had been accepted. (Section 2470.)

Extracts from the Health and Quarantine Laws for the Harbor of San Francisco.—January 1st, A. D. 1873.

The quarantine grounds of the bay and harbor of San Francisco are at the anchorage of Saucelito.—*Political Code*, vol. 1, page 562, Section 3004.

Shipmasters bringing vessels into the harbor of San Francisco, and masters, owners, or consignees having vessels in the harbor, which have on board any cases of Asiatic cholera, small pox, yellow fever, typhus, or ship fever, must report the same in writing to the Health Officer before landing any passengers, casting anchor, or coming to any wharf, or as soon thereafter as they, or either of them, become aware of the existence of either of these diseases on board of their vessels.—*Political Code*, vol. 1, page 564, Section 3013.

No captain or other officer in command of any vessel sailing under a register, arriving at the port of San Francisco, nor any owner, con-

signee, agent or other person having charge of such vessel, must, under a penalty of not less than one hundred dollars, land, or permit to be landed, any freight, passengers or other persons from such vessel, until he has reported to the Health Officer, presented his bill of health, and received a permit from that officer to land freight, passengers, or other persons.—*Political Code*, vol. 1, page 565, Section 3014.

Every pilot who conducts into the port of San Francisco any vessel subject to quarantine or examination by the Health Officer must:

First.—Bring the vessel no nearer the city than is allowed by law.

Second.—Prevent any person from leaving, and any communication being made with the vessel under his charge, until the Health Officer has boarded her and given the necessary orders and directions.

Third.—Be vigilant in preventing any violation of the quarantine laws, and report without delay all such violations that come to his knowledge to the Health Officer.

Fourth.—Present the master of a vessel with a printed copy of the quarantine laws, unless he has one.

Fifth.—If the vessel is subject to quarantine, by reason of infection, place at the masthead a small yellow flag.—*Political Code*, vol. 1, page 565, Section 3015.

Every master of a vessel subject to quarantine, or visitation by the Health Officer, arriving in the port of San Francisco, who refuses or neglects either:

First.—To proceed with and anchor his vessel at the place assigned for quarantine, when legally directed so to do; or,

Second.—To submit his vessel, cargo, and passengers, to the Health Officer, or furnish all necessary information to enable that officer to determine what quarantine or other regulations they ought respectively to be subject to; or,

Third.—To report all cases of diseases and deaths occurring on his vessel, and comply with all the sanitary regulations of the bay and harbor: is liable in the sum of five hundred dollars for every such neglect or refusal.—*Political Code*, page 566, Section 3016.

All vessels arriving off the port of San Francisco from ports which have been legally declared infected ports, or all vessels arriving from ports where there is prevailing at the time of their departure any contagious, infectious, or pestilential disease, or vessels with decaying cargoes, or which have unusually foul or offensive holds, are subject to quarantine, and must be by the master, owner, pilot, or consignee, reported to the Health Officer without delay. No such vessel must cross a right line drawn from Meiggs' Wharf to Alcatraz Island, until the Health Officer has boarded her and given the order required by law.—*Political Code*, page 566, Section 3017.

The Health Officer must board every vessel subject to quarantine or visitation by him, immediately on her arrival; make such examination and inspection of vessel, books, papers, or cargo, or of persons on board, under oath, as he may judge expedient, and determine whether the vessel should be ordered to quarantine, and if so, the period of quarantine. —*Political Code*, page 566, Section 3018.

No captain or other officer in command of any passenger-carrying vessel of more than one hundred and fifty tons burden, nor of any vessel of more than one hundred and fifty tons burden having passengers on board, nor any owner, consignee, agent, or other person having charge of such vessel or vessels, must, under penalty of not less than one hundred dollars, nor more than one thousand dollars, land, or permit to be landed, any passenger from the vessel, until he has presented his bill of health to the Health Officer, and received a permit from that officer to land such passenger; except in such cases as the Health Officer deems it safe to give the permit before seeing the bill of health.—*Political Code*, page 567, Section 3019.

The following fees may be collected by the Health Officer: For giving a permit to land freight or passengers, or both, from vessels of less than one thousand tons burden, from any port out of this State, two and a half dollars; from any port in this State, one dollar and a quarter; frem any passenger-carrying vessel of more than one thousand tons burden, three dollars and seventy-five cents; for vessels of more than one thousand tons burden, carrying no passengers, two dollars and fifty cents; for vaccination of each person, one dollar.—*Political Code*, page 567, Section 3020.

The Board of Health may enforce compulsory vaccination on passengers in infected ships, or coming from infected ports.—*Political Code*, Vol. 1, page 567, Section 3021.

Whenever any cause of action arises under any one of the provisions of this chapter, suit may be maintained thereon in the name of the Health Officer, in any District Court in this State.—*Political Code*, Vol. 1, page 570, Section 3032.

Extracts from the Harbor Police Laws.

No person shall board, or attempt to board, any vessel arriving in the harbor of the City and County of San Francisco, before said vessel has been made fast to the wharf, without obtaining leave from the master, or other person having charge of said vessel, or permission in writing from the owner or owners, or the agent thereof; or having boarded such vessel, shall refuse or neglect to leave the same upon request of the mas-

ter, or other person in charge thereof, under the penalty prescribed in the next succeeding section of this Act.

Any person violating Section One of this Act shall be deemed guilty of a misdemeanor; and upon conviction thereof before the said Judge's Court of said city and county, shall be punished for each offense by a fine not exceding one hundred dollars, or imprisonment in the County Jail of the City and County of San Francisco for a term not exceeding fifty days, or both, in the discretion of the Judge of the said Police Judge's Court, which Court shall have jurisdiction in such cases.

The provisions of the last two foregoing sections shall not apply to any pilot or public officer, visiting a vessel in the discharge of his duty.

The word "harbor," as used in this Act, shall be held to mean and include all the waters of the Bay of San Francisco, within the limits of the City and County of San Francisco; and the word "vessel," as used in this Act, shall be held to mean and include all vessels propelled by steam or sail, plying or bound on a voyage between the said port of San Francisco and other ports in the State, or in any other State of the United States, or in any foreign country.

HARBOR POLICE SIGNALS.

Between sunrise and sunset, the national flag in the mizzen rigging; and between sunset and sunrise, a green or blue light, at least twelve feet above deck.

Extracts of General Laws.

Every captain, master of a vessel, or other person, who willfully imports, brings, or sends, or causes or procures to be brought or sent, into this State, any person who is a foreign convict of any crime which, if committed within this State, would be punished therein, (treason and misprision of treason excepted), or who is delivered or sent to him from any prison or place of confinement, in any place without this State, is guilty of a misdemeanor.—*Penal Code*, page 75, Section 173.

Every person bringing or landing within this State any person born either in the Empire of China or Japan, or the islands adjacent to the Empire of China, without first presenting to the Commissioner of Immigration evidence satisfactory to such Commissioner that such person desires voluntarily to come into this State, and is a person of good character, and obtaining from such Commissioners a permit describing such person, and authorizing the landing, is punishable by a fine of not less than one or more than five thousand dollars, or by imprisonment in the

County Jail not less than two nor more than twelve months.—*Penal Code*, page 76, Section 174.

Every master of a vessel subject to quarantine or visitation by the Health Officer arriving in the port of San Francisco, who refuses or omits: *First.* To proceed and anchor his vessel at a place assigned for quarantine at the time of his arrival; or, *Second.* To submit his vessel, cargo and passengers to the examination of the Health Officer, and to furnish all necessary information to enable that officer to determine to what length of quarantine and other regulations they ought respectively to be subject; or, *Third.* To remain with his vessel at quarantine during the period assigned for her quarantine, and while at quarantine, to comply with the regulations prescribed by law, and with such as any of the Officers of Health, by virtue of authority given them by law, shall prescribe in relation to his vessel, his cargo, himself, his passengers, or crew, is punishable by imprisonment in the County Jail not exceeding one year, or by fine not exceeding two thousand dollars, or both.—*Penal Code*, page 152, Section 376.

Every person who, within the anchorage of any port, harbor, or cove of this State, into which vessels may enter for the purpose of receiving or discharging cargo, throws overboard from any vessel the ballast, or any part thereof, or who otherwise places or causes to be placed, in such port, harbor, or cove, any obstruction to the navigation thereof, is guilty of a misdemeanor.—*Penal Code*, page 226, Section 613.

Every person who entices seamen to desert from any vessel lying in the waters of this State, and on board of which they have shipped for a term or voyage unexpired at the time of such enticement, is guilty of a misdemeanor.—*Penal Code*, page 237, Section 644.

Every person who harbors or secretes any seaman, knowing him to be shipped, and with a view to persuade him to desert, is guilty of a misdemeanor.—*Penal Code*, page 237, Section 645.

When steamers meet, each must turn to the right, so as to pass without interference.—*Political Code*, Vol. 1, page 429, Section 2360.

When any steamer is running in the night time, her master must cause her to carry two conspicuous lights, one exposed near her bow, and the other near her stern; the latter must be at least twenty feet above her deck.—*Political Code*, Vol. 1, page 430, Section 2366.

The owners of every steamboat are responsible for the good conduct of the master or other person in charge employed by them; and they are jointly and severally liable for every penalty incurred by the master, engineer, or other person in charge, which cannot be collected from him by due course of law, as if they were his sureties.—*Political Code*, Vol. 1, page 433, Section 2378.

If any master, owner, agent, or other person having charge or control of any ship, or other vessel, shall refuse or neglect to obey the directions of the Harbor Master, in matters pertaining to the regulations of said port, or removal and stationing any vessel therein, such master, owner, agent, or other person, so refusing or neglecting, shall forfeit and pay a sum not exceeding five hundred dollars, to be recovered, with costs of suit, before either the Fourth or Twelfth District Courts, or not exceeding two hundred dollars, if sued for before the Police Judge, upon whom full and ample jurisdiction in such cases is hereby conferred, or any Justice of the Peace in said city and county, by an action in the name of the city and county, and said Harbor Master shall be a competent witness in the case; and for the amount which shall be recovered such steamer, ship, or other vessel, and the owners thereof, shall be liable.—*Harbor Master Law* of 1857.

Three State Harbor Commissioners.—*Political Code*, Vol. 1, page 96, Section 343.

They have possession of all that portion of the Bay of San Francisco along the water-front of the City and County of San Francisco, and adjacent thereto, to the distance of six hundred feet into the waters of the bay from the line of the water-front, as defined by an Act of the Legislature of this State, approved March 26th, A. D. 1861, together with all of the improvements, rights, privileges, franchises, easements and appurtenances connected therewith, or in anywise appertaining thereto, excepting such portions of the water-front as are held under valid leases; and must also take possession and have the control of any and all such portions of the water-front, with the improvements, rights, privileges, franchises, easements and appurtenances, as are held under valid leases, if any exist, as soon as the leases respectively expire or become void.—*Political Code*, page 467, Section 2522.

The harbor of San Francisco is hereby placed under the control of the Board of State Harbor Commissioners, and they are authorized to regulate the position of ships, their moorings and anchorage, and generally to make rules and regulations concerning them, with power to enforce the same as fully as that formerly used and exercised by the Harbor Master of the City and County of San Francisco.—*Approved March 30th*, 1874.

The Commissioners shall keep the routes of the ferry-boats passing in and out of said harbor free and open at all times, so that ferry-boats can conveniently make their trips without impediment on the part of vessels at anchor or other obstructions. The present Harbor Master of the City and County of San Francisco * * * shall, during his term of office, perform such services in and about the management and regulation of

said harbor as the Commissioners may require of him.—*Approved March 30th*, 1874.

Every person who collects any tolls, wharfage or dockage, or lands, ships, or removes any property upon or from any portion of the water-front of San Francisco, or from or upon any of the wharves, piers, or landings under control of the Board of State Harbor Commissioners, without being by such Board authorized so to do, is guilty of a misdemeanor.—*Penal Code*, page 236, Section 642.

Every person who attempts, by means of any threat or violence, to deter or prevent an executive officer from performing any duty imposed upon such officer by law, or knowingly resists, by the use of force or violence, such officer in the performance of his duty, is punishable by fine not exceeding five thousand dollars, and imprisonment in the County Jail not exceeding five years.—*Penal Code*, page 45, Section 69.

Every person who willfully resists, delays, or obstructs any public officer in the discharge, or attempt to discharge, any duty of his office, when no other punishment is prescribed, is punishable by fine not exceeding five thousand dollars, and imprisonment in the County Jail not exceeding five years.—*Penal Code*, page 67, Section 148.

Every person who willfully obstructs or hinders any public officer from collecting any revenue, taxes, or other sums of money in which the people of this State are interested, and which such officer is by law empowered to collect, is guilty of a misdemeanor.—*Penal Code*, page 148, Section 428.

[Wharfingers and Toll Collectors are public officers.]

Harbor Rules and Regulations made by the Board of State Harbor Commissioners, by Authority of an Act approved March 30th, A. D. 1874, and to take effect on the 1st day of July, 1874.

RULE 1st.—Vessels must not be anchored or moored between a line drawn from the end of Pacific Street Wharf to the most southerly end of Goat Island, and a line drawn from the end of Mission Street Wharf to the point where the southerly end of the Central Pacific Railroad Wharf connects with the Oakland shore, nor must they be anchored in such manner as to permit them to swing between said lines.

RULE 2nd.—Vessels must not be anchored or moored within five hundred yards of a line drawn from the out-shore end of Meiggs' Wharf, southerly along the ends of the wharves, to the out-shore end of Third Street Wharf.

RULE 3rd.—Vessels must not be moored in such manner as to interfere with vessels approaching or leaving the wharves, and vessels moored in the slips between Market Street and Folsom Street wharves must be stationed not less than one hundred and twenty feet from the wharves.

RULE 4th.—Applications for berths must be made to the Chief Wharfinger, the applicant giving the draught of the vessel and kind of cargo to be loaded or discharged; and in no case must a berth be assigned by a person other than the Chief Wharfinger.

RULE 5th.—Vessels, when being moved into a slip or alongside of a wharf, must approach "head on," and when at a wharf must lie head toward the shore. Their studding-sail booms and boom-irons must be removed from their yards; their spritsail yards must be rigged in; their off-shore anchors suspended ready for dropping; their lower and topsail yards braced "sharp up" on their off-shore braces, excepting when in actual use discharging or loading cargo; and when required by the Chief Wharfinger their movable fore-and-aft spars and martingale must be rigged in.

RULE 6th.—Vessels ready to discharge cargoes given the preference over those ready to receive cargo.

RULE 7th.—Persons in charge of vessels must haul such vessels, when required to do so, to make room for vessels requiring immediate accommodations. And vessels lying at the end of wharves must be hauled each way to permit others to be hauled in and out of the slips.

RULE 8th.—Vessels anchored or moored in the harbor, or lying in a slip or dock, must at all times, as well by night as by day, have on board at least one seaman capable of taking proper care of such vessel. If a vessel shall be required to be removed, and no such person is on board, such vessel may be removed by the Harbor Master or Chief Wharfinger at the expense of the owner of such vessel, and the owner and the vessel shall be liable for all damages that shall arise thereby.

RULE 9th.—When ballast, stones, coals, bricks, ashes, cinders, dust, rubbish, or other loose matter or thing that will sink, is being landed from a vessel upon a wharf or landing, or is being transferred from one vessel into another vessel, a canvas, or shoot, or other contrivance, to the satisfaction of the Chief Wharfinger, or Harbor Master, as the case may be, must be used to prevent any part of such substance from falling into the harbor.

RULE 10th.—Fire must not be used on board of any vessel for heating pitch, tar, or other inflammable substance, but may used on floating stages or boats for the purpose of heating such substances for repairing vessels, provided such fire is constantly in the care of a person capable of taking proper care of the same.

RULE 11th.—Vessels having more than twenty-five pounds of gunpowder or other explosive substances on board, must discharge the same north of Vallejo Street, and not less than five hundred yards off-shore, before such vessel approaches any slip, dock or wharf.

RULE 12th.—Every steam engine, when used upon any wharf or landing for loading or unloading cargo, must have upon its smoke-stack a bonnet or spark-catcher that will effectually prevent sparks falling upon such wharf or landing, or upon the deck of any vessel.

RULE 13th.—All coal screens, when in use upon any wharf or landing, must have their sides so covered as to effectually prevent the escape of any coal dust.

RULE 14th.—The number of piles or pieces of timber, permitted to be unloaded from the same vessel into any slip or dock before being removed, not to exceed one hundred, and none allowed to remain in a dock or a slip during the night without the permission of the Chief Wharfinger.

RULE 15th.—All condemned or dismantled vessels must be moored at such places as the Chief Wharfinger shall designate.

RULE 16th.—Stone, sand, earth, rubbish, or any other matter that will sink, must not be deposited upon the shore of the harbor, where from any cause it will be carried into the waters thereof, nor must any such substance be thrown into the harbor without the permission of the Board.

RULE 17th.—All rubbish or other substance landed upon a wharf or landing upon which wharfage is not charged, must be removed therefrom by the party landing the same; and if not removed by such party, will be removed by the wharfinger at the expense of such party.

RATES OF DOCKAGE, WHARFAGE AND TOLLS.

FOR THE PORT OF SAN FRANCISCO.

Established by the Board of State Harbor Commissioners June 7th, 1876.

Tolls.

Vehicles drawn by one or more animals, with loads not exceeding two tons weight or eighty cubic feet	12½ cts.
Loads in excess of two tons, for each additional ton or part thereof	6¼ "
Flour, Grain, Potatoes, and other vegetables, pay for each additional ton or part thereof	5 "
Lumber, when hauled upon the wharf in loads of 2,000 feet or less	12½ "

Tolls—Continued.

Lumber landed upon the wharf or bulkhead, per 1,000 feet board measure	10	cts.
Wood, per cord	12½	"
Bricks, per 1,000	10	"
Coal and Asphaltum, per ton	10	"
Iron, per ton	6¼	"
Ores, Paving Stone, and Ballast, per ton of 2,000 lbs	6¼	"
Hay, per ton of 2,000 lbs	10	"
Vehicles, for transportatiou	12½	"
Wool, in bags, 2 cents; in bales, strapped, 3 cents.		
General Merchandise, per cargo, subject to drayage, per ton of 40 cubic feet or 2,000 lbs	6¼	"
Cattle and horses, for transportation, each	5	"
Calves, each	2½	"
Sheep and Hogs, each	1½	"
Salt, per ton	5	"
Any package of merchandise carried by hand on to any wharf or landing, (except domestic supplies for private individuals, intended for consumption and not for sale, weighing less than 100 lbs)	12½	"
Handcarts, each	5	"
Dry Hides, each	½	"
Milk Wagons, Butcher Wagons, Bakers', Ice, and Laundry Wagons on their daily rounds, may pass free of toll.		
No tolls will be charged on Donkey Engines or Stevedores' Tools going on to any wharf for the purpose of discharging or loading cargo.		

Loads must be estimated either by weight or measurement, as will yield the largest revenue—2,000 lbs. or 40 cubic feet to constitute a ton, excepting Coal, Pig Iron, Asphaltum, and Stone, for which 2,240 lbs. will be a ton.

Tolls must be paid on each load as delivered or received; provided, however, *that owners or consignees may pay in advance the tolls upon entire cargoes, at schedule rates.*

All merchandise landed upon wharves from vessels, and taken from thence in lighters or other vessels, or warehoused without drayage, must pay 6¼ cents per ton wharfage.

All merchandise received or discharged from vessels lying at the wharves, or within that portion of the harbor subject to the jurisdiction of the Board of State Harbor Commissioners. into or from lighters or other vessels, must pay five cents per ton, and bricks five cents per

thousand. Lumber discharged into the water must pay five cents per thousand feet, and piles three cents each. All timber and piles discharged into the slips must be removed within twenty-four hours from the time of such discharge.

All merchandise landed upon the wharves must be removed the same day landed; provided, however, *that by the consent of the wharfinger, and at the risk of the owner, it may remain from day to day, subject to an additional toll for wharfage for every forty-eight hours, or part thereof.*

All merchandise remaining on the wharves after the owner, agent, or consignee has been notified to remove the same, will be removed by the wharfinger at the expense and risk of the owner.

Vessels and their owners are liable for dockage, and all merchandise is liable for tolls, and may be held by the wharfinger to secure the payment thereof.

No load exceeding five tons shall be admitted on or off the wharves, except single packages.

Driving on any wharf or thoroughfare faster than a walk, prohibited; and a non-observance of this rule will subject the offender to a prosecution for misdemeanor.

Parties holding part of the water-front, under lease from the Board of State Harbor Commissioners, are obligated to charge and collect the above rates; and any person violating said rules will forfeit his lease.

By order of the Board of State Harbor Commissioners.

J. A. McCLELLAND, Secretary.

Dockage.

Vessels.	Per day.	Vessels.	Per day.
Under 25 tons	$0 25	1000 tons and und. 1100 tons	$12 50
25 tons and under 50 tons	50	1100 " " 1200 "	13 50
50 " " 75 "	1 00	1200 " " 1300 "	14 50
75 " " 100 "	2 00	1300 " " 1400 "	15 50
100 " " 150 "	3 00	1400 " " 1500 "	16 50
150 " " 200 "	4 00	1500 " " 1600 "	17 50
200 " " 250 "	5 00	1600 " " 1700 "	18 50
250 " " 300 "	6 00	1700 " " 1800 "	19 50
300 " " 400 "	7 00	1800 " " 1900 "	21 00
400 " " 500 "	8 00	1900 " " 2000 "	22 50
500 " " 600 "	8 50	2000 " " 2200 "	23 50
600 " " 700 "	9 50	2200 " " 2500 "	25 00
700 " " 800 "	10 50	And 50 cents for each additional 100 tons.	
800 " " 900 "	11 00		
900 " " 1000 "	11 50		

Vessels loading and ballasting, half the above rates.

Vessels, after being discharged, may lie at the wharves at half rates, subject to the orders of the Chief Wharfinger.

All vessels in outside berths, or in slips, or within premises in the possession and under the control of the Board of State Harbor Commissioners, must pay half rates of dockage.

Dockage to commence upon a vessel making fast to the wharf, or coming within said premises, and to pay for each day or fractional part thereof as a full day. No deduction to be made for Sundays, holidays, or rainy days.

Board of Port Wardens.

It is the duty of the *Port Wardens* to survey the hatches, stowage, and cargo of all vessels arriving at the port of San Francisco, laden with general or assorted merchandise, belonging to or consigned to various parties; also, to survey all vessels arriving in distress, or which have sustained damage at sea, whether to sails, rigging, spars, hull, or otherwise, caused by stress of weather, stranding, collision, or other accident.

A penalty of not less than five hundred nor more than one thousand dollars is imposed for the violation of the law under which the Port Wardens act, (which provides that none but Port Wardens shall hold surveys); they will, however, in marine surveys, recognize and co-operate with such parties as may be designated by the representatives of foreign governments, underwriters, and owners or consignees of vessels.

Telegraph Cables in San Francisco Harbor.

The following landmarks, or monuments, have been erected to indicate the telegraph cable crossing near Benicia.

On the small island opposite Benicia there is a pole, about ten (10) feet high, with a white sign at the end of the pole, lettered "Telegraph cable crosses here."

There is a similar pole and sign in a small ravine or cove on the Contra Costa shore, nearly opposite said island, a little below it, down stream.

The cable extends from the small island aforesaid to the monument on the Contra Costa side.

All persons or vessels damaging or breaking this cable, whether by dragging anchors or otherwise, will be promptly prosecuted. The penalty fixed by law is a fine of not less than five hundred nor more than ten thousand dollars, to which are added full damages arising from injury done to the cable.

Passenger Act of the State of California.

The Passenger Act of the State of California requires *all masters or commanders of vessels, arriving from ports outside the State of California,* to make report to the Commissioner of Immigration within twenty-four hours of arrival. This report is to contain the names of all persons or passengers on board who may be naturalized citizens of the United States; also, their age, nativity, occupation, place and date of naturalization. The report must also contain the names, ages, nationality, and occupation of all persons or passengers on board not citizens of the United States: Masters or commanders of vessels are to require all persons claiming to be naturalized citizens to make oath or to affirm the same, giving the time and place where said naturalization took place.

Special bonds are required for all "lunatic, deaf, dumb, blind, crippled, or infirm persons, whose circumstances make it probable they will become a burden on the State." The penalty for non-report is $200, and $200 per alien passenger not reported.

Act of Congress to Authorize the Appointment of Shipping Commissioners.

By the several Circuit Courts of the United States, to superintend the shipping and discharge of seamen engaged in merchant ships belonging to the United States, and for the further protection of seamen.

(CONDENSED AND CLASSIFIED.)

AGREEMENT.—The master of every ship bound from a port in the United States to any foreign port, or of any ship of the burden of seventy-five tons or upwards, bound from a port on the Atlantic to a port on the Pacific, or *vice versa,* shall, before he proceeds on such voyage, make an agreement, in writing or print, with every seaman whom he carries to sea as one of the crew, which agreement shall be dated at the time of the first signature thereof, and shall be signed by the master before any seaman signs the same, and shall contain the following particulars: First, the nature, and as far as practicable, the duration of the intended voyage or engagement, and the port or country at which the voyage is to terminate; Secondly, the number and description of the crew, specifying their respective employments; Thirdly, the time at which each seaman is to be on board to begin work; Fourthly, the capacity in which

each seaman is to serve; Fifthly, the amount of wages; Sixthly, a scale of the provisions to be furnished to each man; Seventhly, any regulations as to conduct on board, and as to fines, short allowance of provisions, or other lawful punishment for misconduct; Eighthly, any stipulation in reference to advance and allotment of wages.

Every agreement shall be signed by each seaman in the presence of a Shipping Commissionsr, and shall be acknowledged under his seal.

The master shall, at the commencement of each voyage, cause a legible copy of the agreement to be posted up in such part of the ship as may be accessible to the crew, under a penalty of a fine of one hundred dollars.

APPRENTICES.—No apprentice shall be taken to sea without being previously taken before the Commissioner, to whom the indenture must be produced.

CLOTHING.—Every vessel bound to a foreign port shall be provided with at least one suit of woolen clothing for each seaman; also weights and measures for determining the quantity of provisions served out.

FEES.—All fees are to be paid by the master or agent to the Commissioner.

FUEL.—Every vessel bound to a foreign port must be provided with fuel, and a safe and suitable room in which a fire can be kept for the use of seamen.

LOG BOOK.—The master of every vessel bound to a foreign port shall have an Official Log Book, in which he shall keep a record of matters relating to his crew, such as offenses and their punishments, injuries, deaths, etc.

MEDICINES.—Every vessel shall beprovided with a chest of medicines, and those bound across the Atlantic or Pacific, or around Cape Horn or the Cape of Good Hope, shall be provided with a sufficient quantity of lime juice, also sugar and vinegar, or other anti-scorbutics.

NATURALIZATION.—Seamen being foreigners, may become citizens by declaring intent and serving three years in ships of the United States, and are entitled to protection after filing such declaration.

PROVISIONS shall be of good quality, sufficient in quantity, and in accordance with the agreement.

SEAMEN.—The master shall deliver to the Commissioner a full and true account of the wages of each seaman, with all deductions to be made therefrom, and shall give him a certificate of discharge. Any seaman who has signed an agreement and is discharged without his consent or fault, shall be entitled to receive one month's wages in addition to any wages he may already have earned. If a seaman dies on board, the master shall take charge of his money and effects, and shall, if he

think fit, cause them to be sold by auction at the mast, making entry of all particulars in the Official Log Book; and on arrival in port, give an account and pay all moneys and balance of wages due to deceased, to the Shipping Commissioner, or in a foreign port, to the Consul. The penalties of the various offenses of which he may be guilty are imprisonment and forfeiture of wages.

SHIPPING COMMISSIONER.—The general business of the Commissioner shall be to afford facilities for engaging seamen by keeping a register of their names and characters; to superintend their engagement and discharge; to provide means for securing their presence on board, and to facilitate the making of apprentices to the sea service. He shall hear and decide any question between a master, owner, or consignee, and any of the crew, and any award so made by him shall be binding on both parties.

WAGES.—No advance of wages shall be made or advance security given to any person but the seaman himself, or to his wife or mother; and not then, unless the agreement contains a stipulation for the same; and in each case must be made in the presence of the Commissioner. All wages must be paid to a discharged seaman in the presence of the Commissioner.

AMENDMENT TO ABOVE ACT, Approved June, 1874.—None of the provisions of this act shall apply to sail or steam vessels, engaged in the coastwise trade, except the coastwise trade between the Atlantic and Pacific Coasts, or in the lake-going trade, touching at foreign ports or otherwise, or in the trade between the United States and the British North American possessions, or in any trade where the seamen are by custom or agreement entitled to participate in the profit or results of a cruise.

Act of Congress to Prevent Collisions at Sea.

[Approved, April, 1864.]

BE IT ENACTED, *by the Senate and House of Representatives of the United States of America, in Congress assembled:*

That from and after September 1, 1864, the following rules and regulations for preventing collisions on the water be adopted in the Navy and Mercantile Marine of the United States; *provided*, that the exhibition of any light on board of a vessel of war of the United States may be suspended, whenever, in the opinion of the Secretary of the Navy, the

commander-in-chief of a squadron, or the commander of a vessel acting singly, the special character of the service may require it.

PRELIMINARY.

ARTICLE 1. In the following rules every steamship which is under sail and not under steam is to be considered a sailing ship; and every steamship which is under steam, whether under sail or not, is to be considered a ship under steam.

RULES CONCERNING LIGHTS.

Lights.

ART. 2. The lights mentioned in the following articles, and *no* others, shall be carried in all weathers between sunset and sunrise.

Lights for Steamships.

ART. 3. All steam vessels, when under way, shall carry—

(*a.*) At the foremast-head a bright *white* light, so constructed as to show a uniform and unbroken light over an arc of the horizon of twenty points of the compass; so fixed as to throw the light ten points each side of the ship, viz: from right ahead to two points abaft the beam on either side, and of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least *five* miles.

(*b.*) On the *starboard* side a *green* light so constructed as to show a uniform and unbroken light over an arc of the horizon of ten points of the compass; so fixed as to throw the light from right ahead to two points abaft the beam on the *starboard* side, and of such a character as to be visible on a dark night with a clear atmosphere, at a distance of at least *two* miles.

(*c.*) On the *port* side a *red* light, so constructed as to show a uniform and unbroken light over an arc of the horizon of ten points of the compass; so fixed as to throw the light from right ahead to two points abaft the beam on the *port* side, and of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least *two* miles.

(*d.*) The said green and red lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

Lights For Steam Tugs.

ART. 4. Steamships, when towing other ships, shall carry *two* bright *white* mast-head lights vertically, in addition to their side lights, to dis-

tinguish them from other steamships. Each of these mast-head lights shall be of the same construction and character as the mast-head lights which other steamers are required to carry.

Lights For Sailing Ships.

ART. 8. Sailing ships, under way or being towed, shall carry the same lights as steamships under way, with the exception of the *white* mast-head lights, which they shall never carry.

Exceptional Lights for Small Sailing Vessels.

ART. 9. Whenever, as in the case of small vessels during bad weather, the green and red lights cannot be fixed, these lights shall be kept on deck, on their respective sides of the vessel, ready for instant exhibition; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such a manner as to make them most visible, and so that the *green* light shall not be seen on the *port* side, nor the *red* light on the *starboard* side.

To make the use of these portable lights more certain and easy, they shall each be painted on the outside with the color of the light they respectively contain, and shall be provided with suitable screens.

Lights for Ships at Anchor.

ART. 10. Ships, whether steamships or sailing ships, when at anchor in roadsteads or fairways, shall, between sunset and sunrise, exhibit where it can best be seen, but at height not exceeding twenty feet above the hull, a *white* light in a globular lantern of eight inches in diameter, and so constructed as to show a clear, uniform, and unbroken light, visible all around the horizon, and at a distance of at least *one* mile.

Lights for Pilot Vessels.

ART. 11. Sailing pilot vessels shall not carry the lights required for other sailing vessels, but shall carry a *white* light at the mast-head, visible all around the horizon, and shall also exhibit a *flare-up* light every fifteen minutes.

Lights for Fishing Vessels and Boats.

ART. 13. Open fishing boats, and other open boats, shall not be required to carry side lights required for other vessels, but shall, if they do not carry such lights, carry a lantern with a *green* light on the one

side, and a *red* light on the other side, and on the approach of or to other vessels, such lantern shall be exhibited in sufficient time to prevent collision, so that the *green* light shall not seen on the *port* side, nor the *red* light on the *starboard* side. Fishing vessels and open boats, when at anchor or attached to their nets and stationary, shall exhibit a bright *white* light. Fishing vessels and open boats shall, however, not be prevented from using a *flare-up* in addition, if considered expedient.

RULES GOVERNING FOG SIGNALS.

1. Whenever there is a fog by day or night, the fog signals described below shall be sounded.

2. Sailing vessels, and every craft propelled by sails upon the ocean, lakes, and rivers, shall, when on the starboard tack, sound one blast of their fog-horns; when on the port tack, they shall sound two blasts of their fog-horns; when with the wind free or running large, they shall sound three blasts of their fog horns; when lying-to or at anchor, they shall sound a general alarm. In each instance, the above signals shall be sounded at intervals of not more than two minutes.

3. Sailing vessels, when not under way, and anchored or moored in the channel or fairway of commerce, shall sound the general alarm signal at intervals of not more than two minutes, and all steamers navigating in a fog or thick weather shall, by the rules governing pilots, sound their steam-whistles at intervals of not more than one minute.

4. Sailing vessels shall at all times, on the approach of any steamer, during the night-time, show a lighted torch upon that point or quarter to which such steamer shall be approaching. And upon any craft navigating rivers without being in tow of a steamer—such as rafts, flat-boats, wood-boats, and other like craft—they shall sound a fog-horn at intervals of not more than two minutes.

5. It shall at all times be the duty of steamers to give to the sailing vessel, or other craft propelled by sails, every advantage, and to keep out of the way.

STEERING AND SAILING RULES.

Two Sailing Ships Meeting.

ART. 16. If two sailing ships are meeting end on, or nearly end on, so as to involve risk of collision, the helms of both shall be put to *port*, so that each shall pass on the *port* of the other.

Two Sailing Ships Crossing.

ART. 17. When two sailing ships are crossing so as to involve risk of collision, then, if they have the wind on different sides, the ship with

the wind on the *port* side shall keep out of the way of the ship with the wind on the *starboard* side, except in the case in which the ship with the wind on the *port* side is *close-hauled*, and the other ship *free*, in which case the latter ship shall keep out of the way. But if they have the wind on the *same* side, or if one of them has the wind *aft*, the ship which is to *windward* shall keep out of the way of the ship which is to *leeward*.

Two Ships under Steam, Meeting.

ART. 18. If two ships under steam are meeting end on, or nearly end on, so as to involve risk of collision, the helms of both shall be put to *port*, so that each may pass on the *port* side of the other.

Two Ships under Steam, Crossing.

ART. 19. If two ships under steam are crossing, so as to involve risk of collision, the ship which has the other on her own *starboard* side shall keep out of the way of the other.

Sailing Ship and Ship under Steam.

ART. 20. If two ships, one of which is a sailing ship and the other a steamship, are proceeding in such directions as to involve risk of collision, the steamship shall keep out of the way of the sailing ship.

Ship under Steam to slacken Speed.

ART. 21. Every *steamship*, when approaching another ship, so as to involve risk of collision, shall slacken her speed, or, if necessary, stop and reverse; and every steamship shall, when in a fog, go at a moderate speed.

Vessels Overtaking other Vessels.

ART. 22. Every vessel overtaking any other vessel, shall keep out of the way of the said last-mentioned vessel.

Construction of Articles 17, 19, 20, *and* 22.

ART. 23. Where, by the preceding rules, one of two ships is to keep out of the way, the other shall keep her course, subject to the qualifications contained in the following article:

Proviso to save Special Cases.

ART. 24. In obeying and construing these rules, due regard must be had to all dangers of navigation, and due regard must also be had to any special circumstances which may exist in any particular case, rendering a departure from the above rules necessary, in order to avoid immediate danger.

The following circular was issued by the Secretary of the Treasury, June 6th, 1871, addressed to Collectors and other officers of Customs, relating to an amendment (approved February 28th, 1871) of the Act of Congress of 1864, to prevent collisions at sea.

SECTION 70.—*And be it further enacted*, that it shall be the duty of Collectors or other chief officers of the Customs, to require all sailing vessels to be furnished with proper signal lights, as provided for by the Act of April 29th, 1864, entitled "An Act fixing certain rules and regulations for preventing collisions on the water"; and every vessel shall, on approach of any steamer during the night time, show a lighted torch upon that point or quarter to which such steamer shall be approaching. And every such vessel that shall be navigated without complying with the terms of said Act of April 29th, 1864, and the provisions of this section, shall forfeit and pay the sum of $200, one-half to go to the informer, and for which sum the vessel so navigated shall be liable, and may be seized and proceeded against by way of libel, in any District Court of the United States having jurisdiction of the offense.

GEO. S. BOUTWELL,
Secretary.

HURRICANES.

[Compiled.]

Hurricanes are caused by a portion of the atmosphere becoming violently heated, and thereby acquiring a circular motion about a center or focus, and around this focus the wind rushes with great violence. The meteor has also a progressive motion, at a rate varying from twelve to thirty miles per hour. The diameters of these meteors vary from one hundred to three hundred miles. The wind blows with the greatest fury near the center, and there also the shifts of wind are most rapid; towards the circumference the wind has less force, and the time between the changes is of a greater length.

The places most subject to hurricanes are the northern limits of the N. E. trade-wind to the eastward of the meridian of the West India Islands in the N. Atlantic Ocean, and the southern limit of the S. E. trade to the eastward of the meridian of the Island of Mauritius in the

S. Atlantic. Hurricanes also occur in the Bay of Bengal and its vicinity, at the change of the Monsoons in May and October.

Hurricanes in the North Atlantic Ocean commence on the northern limits of the N. E. trade-wind, in August and September, and traveling to the westward, visit the West India Islands, and thence pursue a N. E. course parallel with the Gulf Stream, along the coast of the United States of North America. The diameter of this meteor varies from one hundred to two hundred miles, and its progress is at the rate of about seventeen miles an hour. But the most distinctive feature of this Hurricane is, that it blows from *Right* to *Left*, around the focus or center, it being a calm space.

The Typhoons in the China Sea seem to differ in nothing but name from the Hurricane of the well-frequented seas of the Western Atlantic. They rotate in the same manner (from right to left). They appear to originate in the same latitude, and to travel in the same direction—at first north-westward, till they arrive at the northern limit of the trade-wind, and then turning north-eastward, parallel with the coast of China. The storms occur during both Monsoons, but are more violent during the months of June and July.

The S. W. Monsoon commences about the latter end of April, and continues until October, with much rain and squally weather. Typhoons occur most frequently during this Monsoon. The N. E. Monsoon blows the balance of the year, with generally fine dry weather. The most terrific Hurricanes frequently occur about the *change* of the Monsoons.

Hurricanes in the South Atlantic commence near the southern limits of the S. E. trades, to the eastward of the Islands of Mauritius, and pursue a course to the westward. These are generally looked for during the month of February or March. The distinctive features of these Hurricanes are that they rotate about a focus from *left* to *right*, contrary to the action of similar winds in the Northern Hemisphere. Every ship navigating seas where Hurricanes are likely to occur, should be provided with a *good* barometer and sympiesometer, and strict attention should be paid to their movements. When the barometer falls to 29.50, the weather threatening, and the clouds of a bluish, gloomy appearance, the ship is on the verge of the storm circle, and the focus may be 150 miles distant. As the focus is approached, the barometer falls to 29.20 inches one hundred miles distant, 28.40 at about fifty miles, and to 28 at thirty miles. Near the focus it is sometimes as low as 27.

There is now less danger in encountering these tempests, owing to the skill and researches of Redfield, Reed, Piddington, and others, who have collected a vast number of facts bearing upon and elucidating the general laws by which these storms are governed.

Rules To Avoid Hurricanes.

The vortex of a Typhoon or Hurricane may be avoided, and the ship placed beyond its reach by the following rule:

Place your back to the wind; then if the vessel be in *North* latitude, the vortex of the Hurricane will be on your *left hand*; but, if in *South* latitude, it will be on your *right*; in both cases at right angles from the direction from which you are looking.

IN NORTH LATITUDE.

Hurricane Wind.	Bearing of Focus.	When the Path is to the W. N. W.	When the Path is to the N. E.
East....	South ..	Heave to on starboard tack.	Run before the wind until it has shifted to W. from N., and then heave to on port tack.
N. E....	S. E....	Heave to on starboard tack or run before the wind until it has shifted to N. W., then heave to on port tack.	Heave to on port tack.
North ..	East....	Run before the wind until it has shifted to N. W., or W. N. W., then heave to on port tack.	If desirable to heave to, do so on port tack.
N. W...	N. E....	Heave to on port tack, but in this case the center will pass very close; better run at discretion and then heave to on port tack.	Here it makes no difference on what tack, as the center moves at right angles from you.
West ...	North ..	Heave to on port tack.	Heave to on starboard tack.
S. W...	N. W...	Heave to on port tack.	Heave to on starboard tack.
South...	West. ..	Heave to on starboard tack.	Heave to on starboard tack.
S. E....	S. W...	Heave to on starboard tack.	Here your position is right in front of the path; run to the N. W. until it has shifted to the N. of E., then heave to on port tack.

IN SOUTH LATITUDE.

Hurricane Wind.	Bearing of Focus.	When the Path is to the W. S. W.	When the Path is to the S. E.
West ...	South...	Heave to on starboard tack.	Heave to on port tack.
N. W...	S. W ...	Heave to on starboard tack.	Heave to on port tack.
North ..	West ...	Heave to on port tack.	Heave to on port tack.
N. E ...	N. W...	Heave to on port tack.	Run before the wind S. W. until it has shifted to E. S. E. or S. E., then heave to on starboard tack.
East....	North ..	Heave to on port tack.	Heave to on starboard tack.
S. E....	N. E ...	You may heave to on port tack, but in this case the center will pass very close by; it is better to risk running before the wind N.W. until the wind has shifted to S. W. or W. S. W., then heave to on starboard tack.	Heave to on starboard tack.
South...	East....	Run before the wind to the Northward, or else the center will come too near your vessel; when the wind has shifted to S. W., or W. S.W., heave to on starboard tack.	Heave to on starboard tack.
S. W...	S. E....	Heave to on starboard tack.	Here no shift of wind will take place, as the focus moves away at right angles from the ship.

Table showing the different months in the year in which Hurricanes and Cyclones have been recorded in various regions.

Locality.	Jan.	Feb.	Mch.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North Atlantic and West Indies.....	5	7	11	6	5	10	42	96	80	69	17	7
Southern Indian Ocean, and Mauritius	9	15	15	8	4	..	..	..	1	1	4	6
Northern Indian Ocean; Bay of Bengal, N. E. Monsoon.....	1	..	3	..	..	..	..	..	..	12	7	6
S. W. Monsoon	..	..	..	6	16	4	1	2	1	..	..	..
Arabian Sea and Bombay, N. E. Monsoon	1	1	1	..	..	..	..	..	8	12	9	5
S. W. Monsoon.....	..	..	..	5	9	2	4	5	..	..	..	..
China Sea and North Pacific, Western part.....	..	1	..	..	2	2	12	5	18	14	12	1
Java Sea and Northwest Coast of Australia.....	3	5	1	1	2	..	..	..	..	..	..	2

The Thermometer—Its Uses.

Fahrenheit's Thermometer is used on board ships for the purpose of ascertaining the temperature of the ocean at the surface, and of the air on the ocean.

The Thermometer is a most useful instrument to give warning of the ship's approach to ice in thick, foggy weather. This is known by plunging the Thermometer into a bucket of water, drawn from alongside, at regular intervals during the day, and noting the readings.

In a locality where ice may be expected to be fallen in with, should the mercury in the tube keep sinking, we may conclude that the ship is approaching ice. If it be in the winter season, and the Thermometer has fallen to 34 deg., she will then be only half a mile from the ice. If in the summer, and the Thermometer has fallen to 42 deg., she will then be the same distance off. On a nearer approach, the mercury falls still lower. When the ship has passed the ice, the thermometer again rises. The temperature of the ocean is higher in deep water than in shoal water near the land or on banks. On approaching land, the Thermometer falls from 2 deg. to 6 deg., except with deep water near a high, bold shore, when the change is not so apparent. The temperature as indicated by the Thermometer is also used in connection with the barometric indications in judging the weather.

The Barometer—Barometric Indications.

On board ships the Barometer is relied on for the purpose of foretelling the state of the weather. Confined in a frame is a glass tube containing a column of mercury, which is acted upon by the pressure of the atmosphere; to the frame is attached a scale, marked in inches, and a sliding vernier, the top of which, being set at the height of the mercurial column, gives the measurement in inches and hundredth parts of an inch. In north latitude it stands highest with N. E. winds, and lowest with S. W. In south latitude it stands highest with S. E. winds, and lowest with N. W. About the commencement of a storm in north latitude from the S. W., with rain, the barometer falls, and continues to fall as the storm increases; when it stops and begins to rise, the rain will soon cease, and a shift of wind to the north may be looked for; it may, however, continue to blow hard until the barometer rises to thirty inches.

In south latitude N. W. winds bring rain, with a fallen barometer, but it rises with S. winds. It should always be remembered that the state of the air, as indicated by the barometer, *foretells coming weather*,

rather than shows the present; this invaluable fact is often overlooked. The longer the time between the barometric signs and the change foretold by them, the longer such altered weather will last; and on the contrary, the less the time between the warning and the change, the shorter will be the continuance of such foretold weather.

The following remarks apply more particularly to northern latitudes:

The Barometer and Thermometer should be noticed in connection. If the Barometer has been about its ordinary height, say nearly thirty inches, (at the sea level) and is steady or rising, while the Thermometer *falls*, and dampness becomes less, N. W., N. or N. E. winds may be expected. On the contrary, if a fall takes place with a *rising* Thermometer, and increased dampness, wind and rain will surely follow from the S. E., S. or S. W. A fall of the Barometer, with a low Thermometer, foretells snow in high latitudes. Exceptions to these rules occur, when a N. E. wind with rain, hail or snow is impending, before which the Barometer often rises, on account of the coming wind alone; this often deceives persons who expect fine weather from a "rising glass." When the Barometer is rather below its ordinary height, say down to 29.5 inches at sea level, a rise foretells less wind, or a change in its direction towards the northward, or less wet weather; but when it has been very low, say 29 inches, the first rising usually precedes or indicates *strong* winds, and at times heavy squalls from N. W., N. or N. E., after which violence a gradually rising glass foretells an improvement in the weather, if the Thermometer *falls;* but if the warmth continue, the wind will back round more southerly, or southwesterly, and blow, especially if the Barometer rise suddenly. The most dangerous shifts of wind, or the heaviest northerly gales, happen soon after the Barometer rises from a low point, or, at a later period, if the wind veers gradually. Indications of approaching changes of weather, and the direction of winds, are shown less by the height of the Barometer than by its falling or rising. Nevertheless a height of more than thirty (30) inches is indicative of fine weather, and moderate winds, except from east to north, occasionally. The Barometer is said to be falling when the mercury in the tube is sinking, at which time its upper surface is somewhat concave or hollow, or in Aneroids when the hand moves to the left. The Barometer is rising when the mercurial column is lengthening, the upper surface being then convex or round, or when the hand of the Aneroid moves from left to right. A *rapid rise* of the Barometer always indicates unsettled weather; a slow movement the contrary, as likewise a steady Barometer, which, when continued with dryness of the air, foretells very fine weather. A *rapid* and *considerable fall* foretells stormy weather, rain or snow. *Alternate rising*

and falling (sometimes called pumping) indicates very threatening and unsettled stormy weather. The greatest depressions of the Barometer are with gales from the S. E., S. or S. W. The greatest elevations with wind from N. W., N., or N. E., or with calm. Though the Barometer generally falls with southerly, and rises with northerly winds, the contrary sometimes occurs; in which cases the southerly wind is usually very violent, and accompanied by rain or hail, perhaps with lightning. When a Barometer sinks considerably, much wind, rain, or snow will follow, with or without lightning. The wind will be from the northward, if the *Thermometer* is low, or from the southward if the Thermometer is high (for the season of the year). A *sudden fall* of the Barometer, with a present westerly wind, will be followed by a violent gale from N. W., N. or N. E. If a gale sets in from the E., or S. E., and the wind veers by the S., the Barometer will continue falling until the wind is near a marked change, when a lull *may* occur, after which the gale will be renewed, perhaps suddenly and violently, and the veering of the wind towards the N. W., N., or N. E., will be indicated by the rising of the Barometer and the falling of the Thermometer.

The Coast Survey reports that N. W. winds on the North Pacific Coast are *not* usually predicted by the Barometer, but from the S. E. almost invariably, the mercury falling one inch from its usual height of thirty inches.

The Aneroid Barometer.

The indications given by the Aneroid are the same, in fact, as those by the mercurial column. Its action is governed by atmospheric pressure upon a thin metallic case hermetically sealed, in which has been created a vacuum. The contraction and expansion of this case acts upon a metallic spring, which connected with certain works, regulates the movements of the hand. The inches and hundredths are read off from the circular scales in the same manner as those of the mercurial Barometer, the hand indicating the figures. This instrument is very sensitive and exact, and is a safe guide at times when, by the violent motion of the vessel, the plunging of the mercurial column renders the marine Barometer comparatively useless.

The Chronometer.

The Chronometer is a superior kind of watch, and its advantages for measuring time more accurately are derived from its excellent construction, reduced friction from its peculiar make, and being supplied with a compensation balance, which, when properly adjusted, counteracts the effect of temperature. The reputation of the maker is generally the only

guarantee the purchaser can have for the satisfactory performance of the instrument.

The best position on shipboard for the chronometer is as near the center of motion, and as much removed from liability to shocks and change of temperature, as possible. It should be placed in a case firmly secured, resting upon and surrounded by curled hair or other elastic material.

Magnetism affects the rates of chronometers. It is, therefore, essential that nothing magnetic be placed near them—the magnetic action of the iron on board vessels is sometimes apt to affect the balance. The principal cause, however, of alteration in the rates of chronometers is change of temperature; to obviate this, some surveying vessels keep the temperature of the chronometer-room equable by means of lamps. The rates do not always change immediately, but sometimes at a considerable interval after the change of climate.

If there is but one chronometer on board, it should never be taken from its place in the cabin, for the purpose of marking time for observations; a watch with a second-hand may be used to mark the time, being compared with the chronometer before and after the observation. If there are more than one, the one moved should be compared, before and after moving, with another, to ascertain whether its rate has been disturbed. It has been found by experience that the motion of a chronometer is frequently accelerated, after being received on board, whereby a gaining rate will be increased and a losing one diminished. This effect has been ascribed to the magnetic action exerted by the iron in the vessel on the inner rim of the balance, which is made of steel. When the rate has been accelerated, the longitude resulting from observations made with it will be to the westward of the true longitude; when retarded, to the eastward. The stay should always be carefully set before moving a chronometer, as they are often injured by neglect of this precaution. It should be wound up at a regular hour each morning, so that the same parts may undergo the same constant action. The rate generally changes after a chronometer has been allowed to run down. After winding, always look at the face to see that it has not stopped, and also at the index, to be certain that it is wound up; for it is not uncommon for careless or inexperienced persons to turn the ratchet-key the wrong way, leaving the chronometer unwound. When a chronometer is wound, after running down, it is set going by giving it a small horizontal rotary motion—first taking the precaution to set the stay. Chronometers are sometimes liable to jump one or two seconds in the daily rate without any apparent cause, (but generally from a defect in the adjustment of the escapement) and then resume their former

rate in a few days; they should be compared or rated at every port where reliable opportunity may offer.

The Greenwich Date.

Much needless confusion has been produced by the introduction into treatises on Navigation of three distinct modes of reckoning time, viz: Sea, Civil, and Astronomical Account. The Civil day begins at midnight and ends the following midnight; the first twelve hours are marked A. M., the last twelve hours P. M. The Astronomical day begins at noon, twelve hours after the Civil day commences; the hours are numbered from one to twenty-four, in numerical succession. The use of Sea Account, being productive of much inconvenience, has been abandoned in the U. S. Navy. All the calculations of the Nautical Almanac are adapted to Astronomical time at Greenwich; it consequently becomes necessary to know the Greenwich date, (Greenwich date is adopted as expressing both day and hour) or Astronomical day and hour at Greenwich, when the observation was taken. The Greenwich date is always given in mean time, except the contrary is expressed.

The rule for turning Civil into Astronomical time is: "If the Civil time be A. M., take one from the date and add twelve to the hours, and the result will be the Astronomical time wanted; if the Civil time is marked P. M., discard the designation P. M., and the Astronomical time is had without further change." Thus, January 2d, four hours, A. M., Civil time, is January 1st, sixteen hours, Astronomical day; and January 2d, four hours, P. M., Civil day, is January 2d, four hours, Astronomical day.

TO FIND THE GREENWICH DATE WITHOUT THE CHRONOMETER.

In West longitude find the Astronomical date and add it to the longitude in time; if the sum exceed 24 hours, deduct 24 hours and reckon the time next day.

Example 1.

Required the Greenwich date, June 1st, 9 h. A. M., Civil time, in longitude 76 deg. 30 min. W.

	H. M.	
Civil time, June 1st	09 00	A. M.
Add	12 00	
Astronomical date, May 31	21 00	
Longitude 76 deg. 30 min. W. in time, add	5 06	
	26 06	
Subtract	24 00	
Gives Greenwich date, June 1st	2 06	

Example 2.

Required Greenwich date, June 1st, 9 h. P. M., Civil time, in longitude 76 deg. 30 min. W.

In this case, P. M., Civil date, is—

	H.	M.
Astronomical date, June 1st	09	00
Longitude 76 deg. min. W. in time, add	05	06
Gives Greenwich date, June 1st	14	06

In East longitude, from the Astronomical date subtract the longitude in time; if the longitude in time be greater than the Astronomical date, add 24 hours to the latter, and reckon it the preceding day.

Example 1.

Required Greenwich date, May 15th, 7 A. M., Civil time, in longitude 67 deg. 30 min. E.

	H.	M.
Astronomical date is, May 14th	19	00
Longitude 67 deg. 30 min. E. in time, subtract	4	30
Gives Greenwich date, May 14th	14	30

Example 2.

Required Greenwich date, October 1st, 3 hours 45 minutes P. M., Civil time, longitude 110 deg. E.

	H.	M.
Astronomical date, October 1st	03	45
Add	24	00
	27	45
Longitude 110 deg. E. in time, subtract	7	20
Gives Greenwich date, September 30th	20	25

When it is Noon at the Place.—In West longitude, the Greenwich date is the longitude in time; in East longitude, subtract the longitude in time from twenty-four hours; the remainder is the Greenwich date the preceding day.

Greenwich date, by the methods which have been given, will show whether the chronometer is A. M. or P. M., viz:

If the Greenwich date (or Astronomical time) be less than twelve hours, the chronometer shows P. M.; but if more than twelve hours, the excess is so much past midnight, or A. M.

Of the Gain and Loss of Time in Circumnavigating the Globe.

A ship sailing east or west from any meridian, and returning to that meridian after having circumnavigated the globe, will be found to have gained or lost twenty-four hours.

Thus, sailing west, say from the meridian of Greenwich, when the ship has made 15 deg. of longitude, the mean time will be found to be one hour behind that of the Greenwich chronometer time; continuing her course west until she reaches the longitude of 180 deg. west, she will have lost twelve hours; still proceeding westward, she is now in east longitude, and the longitude is decreasing; when she again arrives at the meridian of Greenwich, she will be twenty-four hours behind time, or have lost one entire day. Hence, when crossing the meridian of 180 deg. west, one day must be discarded. Thus: should we pass 180 deg. west on Sunday, January 5th, the next day must be called Tuesday, January 7th.

When sailing east under like circumstances, when 15 deg. of longitude have been made, the mean time at ship will be one hour ahead of Greenwich chronometer time. When arrived at 180 deg. east, the time at ship will be twelve hours in advance of the chronometer. Passing the meridian of 180 deg. east in west longitude, and continuing eastward, we decrease our longitude, until having arrived again at the meridian of Greenwich, we find that we have gained twenty-four hours on the voyage.

Hence, when coming to 180 deg. east, and crossing to west longitude, one day must be counted twice. Thus: should we pass the meridian of 180 deg. east on Sunday, January 5th, the next day must likewise be called Sunday, January 5th.

To find the Longitude by Chronometer at Noon, from Equal Altitudes of the Sun.

A. M.—Observe an altitude of the sun about thirty minutes from noon: note the altitude and time of observation by chronometer.

P. M.—Clamp the index of the sextant or quadrant at the same altitude as observed before noon, and when the sun falls to it, again note the time by chronometer.

Add together these two chronometer times and find half their sum; to this half-sum apply the chronometer error as usual; the result will be the mean Greenwich time; to this Greenwich time apply the equation of time corrected the contrary way, as indicated in the "Nautical Almanac," and the product will be the Greenwich apparent time, which in west longitude is the longitude in time at apparent noon, corre-

sponding to the time at which the meridian observation is taken for latitude.

Example.

April 20th, 1879 (Civil day). Before noon the altitude of the Sun's lower limb was observed to be 67 deg. 58 min.; time by chronometer, 8 h. 19 m. 15 s. When the sun fell to the same altitude after noon, the time by the chronometer was 9 h. 23 m. 21 s.—chronometer slow, 2 m. 15 s. Required the longitude.

Approximate Greenwich date, April 20th..... H. M. 9 00

	H.	M.	S.			S.
A. M. Time by Chronom.	8	19	15	Hourly diff. of Equation.		0.54
P. M. Time by Chronom.	9	23	21	Greenwich hours.....		9
Sum.....	17	42	36	Correction of Equation..		4.86
					M.	S.
Half-sum.....	8	51	18	Equation Naut. Alm'c...	1	05.0
Chronometer slow, add...		2	15	Equa. increasing add....		4.9
Greenwich Mean Time...	8	53	33	Corrected Equation.....	1	09 9
Equation of Time directed subtract, hence add, being applied to mean time		1	10			
Greenwich apparent time at apparent noon at ship, and is the longitude in time	8	54	43	=133° 40′ 45″ West longitude.		

In East longitude, the difference between apparent noon at the ship and the Greenwich time by chronometer, reduced to apparent time, is the longitude in time.

Example.

April 4th, 1879. Before noon the altitude of the Sun's lower limb was observed to be 86 deg. 10 min.; time by chronometer, 1 h. 50 m. 0 s. When the sun fell to the same altitude after noon, the time by chronometer was 2 h. 16 m. 0 s. Chronometer fast, 1 m. 10 s. Required the longitude.

Approximate Greenwich date, April 3d..... H. M. 14 00

	H.	M.	S.		S.
A. M. Time by Chronom.	1	50	00	Hourly diff. of Equation	0.75
P. M. Time by Chronom.	2	16	00	Greenwich hours.....	14
Sum	4	06	00		3.00
Half-sum	2	03	00		7.5
Chronom. fast, subtract..		1	10	Correction of Equation..	10.50

					M.	S.
Greenwich Mean Time...	2	01	50	Equation Naut. Alm'c...	3	24 .4
Equation of time, directed add, hence substract, being applied to mean time		3	14	Equa. decreasing, subtract		10 .4
				Corrected Equation.....	3	14 .0
Greenwich apparent time.	1	58	36			
Apparent noon at ship...	12	00	00			

Difference in long. in time. 10 01 24=150° 21′ 00″ East longitude.

NOTE.—When a ship is making much northing or southing in the interval between the altitudes, if sailing toward the sun, after having noted the chronometer time, increase the A. M. altitude by advancing the index of the instrument equal to the difference of latitude made in the interval; sailing from the sun, decrease the A. M. altitude by moving the index back, equal to the difference of latitude made in the interval, noting the time for the same altitude P. M. without further correction.

To Find the Apparent Time and Longitude by Chronometer at Sunrise and Sunset.

RULE.

Observe with a spy-glass the instant the upper or lower limb of the sun touches the horizon, and note the time by the chronometer.

Bring the latitude forward to the time of observation, correct the declination, and find the polar distance, as in ordinary cases.

When the lower limb is observed, take the difference between the sun's semi-diameter (N. A.) and the refraction, (Table XII, Bowditch) for 00 deg. 00 min. alt., from which subtract the parallax for 00 deg. 00 min. alt., (Table XIV, Bowditch). To this add the dip of the horizon (Table XIII, Bowditch) corresponding to the height of the eye above the sea level. The result constitutes a correction, usually about 22′, which must be subtracted from the sum of the latitude and polar distance, and added to the half-sum.

When the upper limb is observed, add together the refraction less the parallax, the sun's semi-diameter, and the dip of the horizon. This correction is usually about 54′, and is also subtracted from the sum of the latitude and polar distance, and added to the half-sum.

The apparent time is found by the rule given on page 208 (Bowditch), for working the time by the tables, and the longitude by turning the difference between this time and the Greenwich date into degrees and minutes; except great accuracy is required, the application of 22 minutes as a correction for the sun's lower limb, and 54 minutes for the

upper, subtracted and added, as above directed, will give an approximate result.

Example.

December 10th, 1879. Civil time, in latitude 42 deg. 00 min. north, and longitude 135 deg. 00 min. west, the Sun's lower limb was observed to set at 4 h. 30 m. P. M. Time by chronometer, 1 h. 30 m. 00 s.; error, 4 min. 00 sec. fast; height of eye, thirty feet. Required the apparent time and longitude.

	′ ″		H. M. S.		
Refraction.....	30 00	App. time of obs..	4 30 00	Hourly diff. declination..	13.6
Sun's S. D.....16 17		Long. 135° West, in time add.	9 00 00	Greenwich hours and parts.....	13.5
	16 47	Greenwich date...	13 30 00		
Parallax.....	9				680
	16 38	Declination .. 22° 55′ 20″ S.			408
Dip (add).....	5 23	Increasing, add cor.	3′ 04″		136
	16 34	Correct declin'n.	22 58 24		60)183.60
Correction.....21 57			90		
				Cor. of declination.....	3′ 03″.6
		Polar distance..	112 58 24		
	° ′				
Sun's altitude.....	00 00			Hourly difference, equation	1.14
Latitude.....	42 00	secant...	0.12893	Greenwich, hours & parts	13.5
Polar distance	113 00	co-sec'nt.	0.03597		570
					342
Sum	155 00				114
Correction	— 22				
	154 38			Correction.....	15.390
Half sum.....	77 19	co-sine...	9.34156		M. S.
Correction, add.....	22			Equation.....	7 06.1
				Decreasing, subtract....	15.4
	77 41	sine.....	9.98989		
			19.49635	Corrected equation.....	6 50.7
	H. M. S.		9.74817	=4 h. 32 m. 26 s. apparent time.	
Time by chro.....	1 30 00			6 51 equa., subtract	
Chro. fast, subtract,	4 00			4 25 35	
	1 26 00				
Add.....12 00 00					
Greenwich mean time	13 26 00				
Time at ship.....	4 25 35				
Long. in time.....	9 00 25	=135° 06′ 15″ west longitude.			

To find the Sun's Declination from the Nautical Almanac.

Find the Greenwich date; take from the "Nautical Almanac" the declination for apparent noon and the hourly difference. If the declination is increasing, mark the difference—add; if decreasing—subtract; reduce the time to hours and decimal parts of an hour, and multiply the hourly difference by it; reduce the product to minutes and seconds, and add it to or subtract it from the declination at noon, as indicated by the sign.

Example 1.

Required, the Sun's declination, at noon, November 6th, 1879, in longitude 153 deg. 47 min. West.

	H.	M.
Local Astronomical date is November 6th	00	00
Longitude 153 deg. 45 min. West, in time, add	10	15
Greenwich date is November 6th	10	15

	"		°	′	″
Hourly difference	45.1	Sun's declination	15	57	59
Hours, Greenwich time, and decimal parts	10.25	Declinat'n, increasing, add		7	42
	2255	Required declination	16	05	41
	902				
	451				
	60)462.275				
	7′ 42″.2				

Example 2.

Required, the Sun's declination, January 9th, 1879, at 9 A. M., in longitude 97 deg. 08 min. East.

	H.	M.
Local Astronomical date is January 8th	21	00
Longitude 97 deg. 08 min. East, in time, subtract	6	30
Greenwich date is January 8th	14	30

	"		°	′	″
Hourly difference	20.2	Sun's declination	22	15	31
Hours, Greenwich time, and decimal parts	14.5	Declination decreasing, subtract		4	52
	1010	Required declination	22	10	39
	808				
	202				
	60)292.90				
	4′.52″				

NOTE.—In these examples, as in all other cases, the hourly difference being in seconds, with a decimal fraction, renders it necessary that, when multiplied by the hours and minutes of time, these minutes should also be reduced to decimals of an hour. Vulgar fractions are turned into decimal fractions by dividing the numerator by the denominator, thus: 15 minutes being 15 sixtieths of an hour, 15 divided by 60 gives .25 for the decimal fraction; and again, in like manner, 6 h. 30 m. is equal to 6.5 hours.

MEAN TIME OF TRANSIT OF THE POLE STAR OVER THE MERIDIAN.

Also, the Eastern and Western Elongations for every Tenth Day in 1879, *Calculated for the Longitude of San Francisco.*

1879.	Lower Transit. Morning.	1879.	Upper Transit. Morning.	1879.	Western Elongat'n. Morning.	1879.	Eastern Elongat'n. Morning.
	H. M. S.		H. M. S.		H. M. S.		H. M. S.
Jan. 1	6 30 55	July 9	6 5 53	Jan. 1	0 31 54	July 9	0 6 52
Jan. 10	5 55 25	July 19	5 26 44		evening.		evening.
Jan. 20	5 15 57	July 29	4 47 34	Jan. 10	11 52 28	July 19	11 23 47
Jan. 30	4 36 28	Aug. 8	4 8 23	Jan. 20	11 12 30	July 29	10 44 37
Feb. 9	3 57 01	Aug. 18	3 29 13	Jan. 30	10 33 31	Aug. 8	10 5 26
Feb. 19	3 17 34	Aug. 28	2 50 01	Feb. 9	9 54 4	Aug. 18	9 26 16
Mar. 1	2 38 09	Sept. 7	2 10 48	Feb. 19	9 14 37	Aug. 28	8 47 4
Mar. 11	1 58 44	Sept. 17	1 31 34	Mar. 1	8 35 12	Sept. 7	8 7 51
Mar. 21	1 19 22	Sept. 27	0 52 19	Mar. 11	7 55 47	Sept. 17	7 28 37
Mar. 31	0 40 1	Oct. 7	0 13 3	Mar. 21	7 16 25	Sept. 27	6 49 22
April 10	0 00 42		evening.	Mar. 31	6 37 4	Oct. 7	6 00 6
	evening.	Oct. 17	11 29 49	April 10	5 57 45		W. elong
April 20	11 17 29	Oct. 27	10 50 29		E. elong.		morning
April 30	10 38 14	Nov. 6	10 11 9		morning	Oct. 17	5 32 46
May 10	9 59 0	Nov. 16	9 31 47	April 20	5 20 26	Oct. 27	4 53 26
May 20	9 19 47	Nov. 26	8 52 23	April 30	4 41 11	Nov. 6	4 14 6
May 30	8 40 36	Dec. 6	8 12 58	May 10	4 1 57	Nov. 16	3 34 44
June 9	8 1 25	Dec. 16	7 33 32	May 20	3 22 44	Nov. 26	2 55 20
June 19	7 22 15	Dec. 26	6 54 5	May 30	2 43 33	Dec. 6	2 15 55
June 29	6 43 06	Dec. 31	6 34 21	June 9	2 04 22	Dec. 16	1 36 29
				June 19	1 25 12	Dec. 26	0 57 2
				June 29	0 46 3	Dec. 31	0 37 18

The times for the intermediate days can readily be found by proportion. The Pole Star is so slow moving, that if an observation taken be within ten or fifteen minutes of the time given, the error in latitude will be trifling. If the place of observation be not in the meridian of San Francisco, to the times given add 9.8 seconds for every fifteen degrees, or one hour of longitude, if to the west of San Francisco; or subtract, if to the east. For examples, in finding latitude by means of the above table, see next page.

To Find the Latitude by the Pole Star.

During the year 1879, the mean declination of the Pole Star at its Upper Transit will be 88 deg. 40 min. North; at its Lower Transit 91 deg. 20 min., and at each Elongation 90 deg.

In observations for latitude: after finding the altitude, subtract the proper correction for dip and refraction (generally 5 min.); then if the star is passing the Upper Transit, subtract the complement of the declination (that is, the difference between it and 90 deg.=1 deg. 20 min.) and the result is the latitude required.

If the star is passing its Lower Transit, add 1 deg. 20 min., with like result.

If the star is at either of its elongations, no other corrections are to be applied than those for dip and refraction.

Examples.

I.—On the 9th July, 1879, at 6 h. 06 m. A. M., San Francisco time, the observed altitude of the Pole Star at the Upper Transit was 47 deg. 47 min.; height of the observer 18 feet; required the latitude.

II.—On the 30th May, 1879, at 8 h. 40 m. P. M., the observed altitude of the Pole Star at the Lower Transit was 54 deg. 20 min.; height of the observer 10 feet; required the latitude.

III.—On the 27th October, 1879, at 4 h. 53 m. A. M., the observed altitude of the Pole Star at the Western Elongation was 26 deg. 15 min.; height of the observer 26 feet; required the latitude.

I.

	D.	M.
Observed altitude	47	47
Subtract dip 4 m., refr. 1 m.		5
True altitude	47	42
Subtract comp. of dec	1	20
Latitude	46	22

II.

	D.	M.
Observed altitude	54	20
Subtract dip 4 m., refr. 1 m.		5
True altitude	54	15
Add comp. of dec	1	20
Latitude	55	35

III.

	D.	M
Observed altitude	26	15
Subtract dip 5 m., refr. 2 m...		7
True altitude	26	08

And is also the latitude.

The Equation of Time.

Find the Greenwich date; take the equation of time and hourly difference, from the "Nautical Almanac"; reduce the time to hours and decimal parts, and multiply the hourly difference by it; add the product if the equation is increasing; subtract, if decreasing.

Required, Equation of time corresponding to date and longitude given in Example 1, for finding the sun's declination.

Greenwich date, November 6th, 1879, is..... H. M. 10 15

	s.		M.	s.
Hourly difference.....	0.11	Equation of time.....	16	15.7
Hours, Greenwich time, and decimal parts.....	10.25	Equation decreasing, subtract correction		1
	55	Equation required.....	16	14.6
	22	To be subtracted from apparent time.		
	11			
	1.1275			

Required, Equation of time corresponding to date and longitude given in Example 2, for finding the sun's declination:

Greenwich date, January 8th, 1879, is..... H. M. 14 30

	s.		M.	s.
Hourly difference.....	1.06	Equation of time.....	6	54.0
Hours, Greenwich time, and decimal parts.....	14.5	Equation increasing, add correction		15.4
	530	Equation required.....	7	09.4
	424	To be added to apparent time.		
	106			
	15.370			

RAIN-FALL IN SAN FRANCISCO, CAL., (1849 TO 1878) AS RECORDED BY THOMAS TENNENT.

FROM 1849 TO 1863.

	1849.		1850.		1851.		1852.		1853.		1854.		1855.		1856.		1857.		1858.		1859.		1860.		1861.		1862.	
	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.
July	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.02	1	.....	..	.05	2	....	..	.21	1	.....	..	.....	..
August	.....	..	.....	..	.....	..	.....	..	.04	1	.01	1	.....	..	.....	..	.05	2	.16	2	.02	1	.....	..	.....	..	.....	..
September	.....	..	0.33	4	1.03	1	.....	..	.46	4	.15	3	.....	..	.07	2	.....	..	.....	..	.03	1	.....	..	.02	1	.....	..
October	3.14	3	.....	..	.21	2	.80	1	.12	2	2.41	9	.....	..	.45	5	.93	3	2.74	4	.05	1	.91	12	.....	..	.40	2
November	8.66	8	.92	7	2.12	5	5.31	12	2.28	12	.34	2	.67	7	2.79	9	3.01	11	.69	5	7.28	15	.58	2	4.10	12	.15	3
December	6.20	12	1.05	4	7.10	14	13.20	20	2.32	11	.81	3	5.76	15	3.75	12	4.14	8	6.14	14	1.57	6	6.16	21	9.54	16	2.35	9
	1850.		**1851.**		**1852.**		**1853.**		**1854.**		**1855.**		**1856.**		**1857.**		**1858.**		**1859.**		**1860.**		**1861.**		**1862.**		**1863.**	
January	8.34	15	.72	5	.58	4	3.92	11	3.88	10	3.67	11	9.40	13	2.45	7	4.36	8	1.28	4	1.64	8	2.47	8	24.36	18	3.63	9
February	1.77	5	.54	4	.14	4	1.42	5	8.04	16	4.77	10	.50	4	8.59	15	1.83	8	6.32	18	1.60	7	3.72	8	7.53	10	3.19	10
March	4.53	7	1.94	9	6.68	14	4.86	6	3.51	11	4.64	12	1.60	5	1.62	6	5.55	8	3.02	11	3.99	13	4.08	8	2.20	11	2.06	8
April	.46	3	1.23	8	.26	3	5.37	8	3.12	9	5.00	10	2.94	6	.....	..	1.55	4	.27	4	3.14	8	.51	4	.73	9	1.61	9
May	.....	..	.67	3	.32	1	.38	7	.02	1	1.88	6	.76	3	.02	3	.34	3	1.55	4	2.86	11	1.00	3	.74	5	.23	2
June	.....	..	.....	..	.....	..	.....	..	.08	2	.....	..	.03	1	.12	1	.05	1	.....	..	.09	2	.08	2	.05	1	.....	..
	33.10	53	7.40	44	18.44	48	35.26	70	23.87	79	23.68	67	21.66	54	19.81	61	21.88	56	22.22	68	22.27	73	19.72	70	49.27	83	13.62	52

Rain Gauges complete, with instructions, $12. Made and for sale by Thomas Tennent, No. 18 Market St.

RAIN-FALL IN SAN FRANCISCO, CAL., (1849 TO 1878) AS RECORDED BY THOMAS TENNENT.

FROM 1863 TO 1878.

	1863.		1864.		1865.		1866.		1867.		1868.		1869.		1870.		1871.		1872.		1873.		1874.		1875.		1876.		1877.	
	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.	Quantity.	Days.
July	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	0.03	2	.....	..	.....	..	.01	1	.....	..
August.	.....	..	.21	3	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	0.15	3	.....	..	.....	..	.02	2	.....	..
Sept ...	.03	1	.01	1	.24	2	.11	2	.04	1	.....	..	.12	1	.03	1	.03	2	0.14	1	.....	..	0.08	2	.....	..	.26	3	.....	..
October	.....	..	.13	3	.26	4	.....	..	.20	1	.15	3	1.29	2	.....	..	.11	2	0.21	1	0.68	2	2.73	8	0.22	2	2.69	7	.58	4
Nov....	2.55	5	6.68	8	4.19	10	3.35	12	3.41	6	1.18	5	1.19	5	.43	4	3.72	9	2.62	3	1.31	6	5.92	7	6.73	15	23	3	1 38	8
Dec	1.80	8	8.91	18	.58	8	15.16	18	10.69	18	4.34	11	4.31	7	3.38	8	16.74	14	7.45	10	10.12	20	0.28	4	3.08	10	.....	.	2.37	7

	1864.		1865.		1866.		1867.		1868.		1869.		1870.		1871.		1872.		1873.		1874.		1875.		1876.		1877.		1878.	
January	1.83	5	5.14	9	10.88	16	5.16	15	9.50	17	6.35	14	3.89	9	3.07	7	4.22	10	2.17	8	4.85	14	6.97	11	6.41	14	4.36	9	10.69	16
Feb	.....	..	1.34	8	2.12	9	7.20	9	6.13	9	3.90	5	4.78	9	3.76	10	6.97	20	4.24	17	1.83	10	0.20	1	3.96	7	1.14	7	10.75	13
March .	1.52	9	.74	4	3.04	12	1.58	7	6.30	12	3.14	12	2.00	8	1.29	8	1.64	10	0.78	4	3.55	15	1.08	6	4.37	11	.91	7	4.26	13
April ..	1.57	4	.94	3	.12	1	2.36	8	2.31	9	2.19	5	1.53	4	1.93	5	1.10	7	0.52	3	1.04	7	0.02	1	1.04	8	.25	6	.96	4
May ...	.78	5	.63	2	1.46	6	.....	..	.03	2	.08	2	.20	2	.21	3	.16	3	0.01	1	0.34	4	0.11	2	0.18	1	.13	1	.12	2
June ...	.....	..	.....	..	.04	1	.....	..	.23	3	.02	1	.....	..	.....	..	.02	2	0.08	1	0.08	2	1.01	3	0.02	1	.....	..	.01	1
	10.08	37	24.73	59	22.93	69	34.92	71	38.84	78	21.35	58	19.31	47	14.10	46	34.71	79	18.02	49	23.98	85	18.40	45	26.01	69	10.00	46	31.12	68

Average Rain-fall from the Season of 1849-50 to that of 1877-8—29 Seasons, 23.6 Inches.

N. S. THOMPSON

SUCCESSOR TO

JAMES CURTIS & CO.,

DRUGGIST,

Cor. Stewart and Market Streets, SAN FRANCISCO.

Particular attention paid to replenishing Ships' Chests with PURE Medicine.

A GOOD ASSORTMENT OF

Medicine Chests always on hand, at Reasonable Prices

CHAS. E. HASELTINE & CO.

STEVEDORES

—AND—

BALLASTMEN

No. 36 STEUART ST.

San Francisco, Cal.

Vessels Discharged, Ballasted, and Loaded Carefully and with Dispatch.

H. C. PITTMAN. FRANK MIDDLETON. J. G. LEVENSALER.

PITTMAN, MIDDLETON & CO.

STEVEDORES

OFFICE, WITH

G. M. JOSSELYN & CO.

Nos. 38 and 40 Market Street,

P. O. Box 1693. *SAN FRANCISCO.*

R. P. DAVIES,

IRON VESSELS

TAKEN INTO DOCK

—AND—

Bottoms Cleaned and Coated.

OFFICE:

No. 508 BATTERY ST.

Opp. the Custom House, **SAN FRANCISCO.**

SHIP MASTERS

WILL FIND A FULL ASSORTMENT OF

GALVANIZED WIRE ROPE

FOR STANDING RIGGING,

STEEL TOWING LINES AND HAWSERS,

Copper Wire Rope, Lightning Conductors,

MANUFACTURED BY

A. S. HALLIDIE

No. 6 CALIFORNIA ST.

At Junction of Market, *SAN FRANCISCO.*

N. B.—Wire Rope is lighter, smaller and more durable than any other kind of Rope, is not affected by atmospheric changes, has less than half the surface exposed to the wind, and costs 40-100ths less than hemp.

STEWART MENZIES. ARTHUR McCRACKEN. HENRY BINGHAM

MENZIES, BINGHAM & CO.

STEVEDORES

Office, Old Merchants' Exchange,

Nos. 512 and 514 Battery Street,

Opposite Custom House, San Francisco.

THE OLDEST LOCAL

MARINE AND FIRE.

THE

California Insurance Co.

ORGANIZED FEBRUARY, 1861.

OFFICE, - 318 CALIFORNIA STREET,

Three Doors East from Sansome, San Francisco.

CAPITAL PAID UP *$300,000*
ASSETS, January 1st, 1878.....*$527,730*

C. T. HOPKINS, President. H. B. TICHENOR, Vice-President.
Z. CROWELL, Secretary.
CAPT. D. F. HUTCHINGS, Marine Surveyor, also Veritas Surveyor.

MILTON ANDROS,

Counselor-at-Law

AND

PROCTOR IN ADMIRALTY,

224 Sansome, S. E. Cor. California St.

SAN FRANCISCO.

SUTTON & CO.

MANUFACTURERS OF

CAPE ANN OIL CLOTHING

AND

RUBBER GOODS.

Ship Masters Supplied with Slops Throughout

Nos. 34 & 36 California St., Third Floor.

COMMERCIAL

Insurance Company

OF CALIFORNIA.

FIRE AND MARINE !

This Company aims to secure the Best Risks on all desirable hazards, at Remunerative Rates. Prompt and Equitable Adjustment and Payment of Losses.

Paid up Capital, - - - $200,000

JOHN H. WISE, President. CHAS. A. LATON, Secretary

Office, 405 California Street, San Francisco.

CAPT. A. Y. TRASK, Marine Surveyor

THEODORE H. ALLEN THOMAS YOUNG

ALLEN & YOUNG,

PIONEER

STEVEDORES

SAN FRANCISCO.

OFFICE, 1026 BATTERY ST.

BOX 928.

JAS. B. CHASE CAPT. C. WOLFF

CHASE & WOLFF,

STEVEDORES

—AND—

BALLASTMEN,

Front Street, Near Vallejo

SAN FRANCISCO, CAL.

Cargoes Discharged with Promptness and Dispatch.

THE
FIREMAN'S FUND
INSURANCE COMPANY.

D. J. STAPLES, President.
ALPHEUS BULL, Vice-President.
GEO. D. DORNIN, Secretary.
W. J. DUTTON, Marine Secretary.
CAPT. CORY WILLISSTUN, Marine Surveyor.
BISHOP & CO., Agents, Honolulu, H, I.
H. HEWETT & CO., Agents, Portland, Oregon.

Office, S. W. cor. Sansome and California Sts.

SAN FRANCISCO, CAL.

CAPITAL AND ASSETS,

$800,000 GOLD!

MARINE RISKS

Accepted under all approved forms and for all desirable voyages.

FIRE AGENCIES

In all the principal cities of the Union.

The Fire Income of this Company is derived from moderate lines, well distributed, thus avoiding the liability to overwhelming disaster to Policy Holders and Company attendant upon a HEAVY CONCENTRATION OF HAZARD.

Taber

CORNER

Montgomery & Market Streets

OVER HIBERNIA BANK.

(Ascend in the Elevator)

SAN FRANCISCO.

PORTRAITS.

ESTABLISHED IN 1851.

THOMAS HOUSEWORTH & CO.

Practical Opticians

AND

PHOTOGRAPHERS

12 Montgomery St., up Stairs,

SAN FRANCISCO, CALA.

Brazilian Pebble Spectacles

Marine, Field and Opera Glasses,
Marine and Pocket Telescopes,
Boat and Pocket Compasses,
Microscopes, Stereoscopes & Views.

FINEST POCKET CUTLERY,

SCISSORS, RAZORS AND STROPS.

Photographic Views of California Scenery,
Photographs of Celebrities,
Photographs of Ships, Buildings, Etc., Etc.

Special Rates to Captains for Photographs, which are considered the finest in the world.

☞PRICES GREATLY REDUCED.

12 Montgomery Street, San Francisco.

TENNENT'S

Nautical Almanac,

TIDE REGISTER

FOR

THE PACIFIC COAST,

AND

MARINE DIGEST

FOR

1889.

By THOMAS TENNENT

CHRONOMETER AND INSTRUMENT MAKER,

OFFICIAL REGULATOR OF CITY TIME FOR THE PAST TWENTY-THREE YEARS.

SIGN OF THE "WOODEN SAILOR," No. 18 MARKET STREET,

SAN FRANCISCO.

NOTICE.

The Local Tables in this Nautical Almanac, viz, High Water at San Francisco, San Diego, Astoria and Port Townsend, Rising and Setting of the Sun and Moon, and also the Moon's Phases, are computed for

PACIFIC STANDARD TIME,

Eight Hours Slower than Greenwich Time.

Entered according to Act of Congress, in the year eighteen hundred and eighty-eight,

BY THOMAS TENNENT,

In the office of the Librarian of Congress at Washington.

BACON & COMPANY, PRINTERS,
508 Clay Street, San Francisco.

TABLE OF CONTENTS.

	PAGE.
Preface	3
Table of Contents	4
Eclipses, Chronological Cycles, Morning and Evening Stars, for 1887	5
High Water at San Francisco, California	6
High Water at San Diego, California	
High Water at Astoria, Oregon	
High Water at Port Townsend, Washington Territory	to
Sun Rising and Setting at San Francisco	
Moon Rising and Setting at San Francisco	
The Sun's Right Ascension at Greenwich, App. Noon, with Hourly Difference	
The Sun's Declination at Greenwich, Apparent Noon, with Hourly Difference	
The Equation of Time at Greenwich, Apparent Noon, with Hourly Difference	29
Rule and Table to find the time of Low Water at all points on the Coast	30
Table of Tidal Constants to find High Water at all points on the Coast	31
Light-House Buildings and Towers (description of) on West Coast U. S.	32
Light-Houses on West Coast United States with description of Lights, etc	34
Fog Signals on the Coasts of California, Oregon, and Washington Territory	35
COAST DIRECTORY—Distances from San Francisco, Up the Coast	36
COAST DIRECTORY—Distances from San Francisco, Down the Coast	37
Moon's Phases at San Francisco (Pacific Standard time)	38
Harbor Rules and Regulations of the Port of San Francisco, Rates of Dockage, Wharfage, and Tolls, etc	39 to 47
Pilot Regulations of the Port of San Francisco	48
Quarantine Laws of the Port of San Francisco	49
Harbor Police Signals	52
Board of Port Wardens, San Francisco Harbor, their duties	52
Passenger Act of the State of California	52
Subaqueous Telegraph Cables in San Francisco Harber	52
Pilot Act for Columbia River and Bar	53
Act of Congress in relation to Coloring, Numbering, and Placing Buoys, Beacons, Spindles, Stakes, etc	54
Sailing Directions for Harbors on West Coast of United States, also List of Buoys and Beacons marking the Coast and Harbors from San Diego to Olympia	55 to 85
Rocks, Shoals and Dangers adjacent to West Coast United States	86 to 99
Coast of Alaska, new discoveries of Dangers	99
U. S. Shipping Commissioner, general duties, etc	99
Synopsis of the Dingley Shipping Act with latest amendments	100
Revised International Regulations to Prevent Collisions at Sea	102 to 107
Rules and Regulations for the government of Pilots, adopted by the U. S. Supervising Inspectors of Steam Vessels	107
U. S. Life-Saving Service on the West Coast of the United States, with full directions, Stations, etc	110
Trade Winds in the Eastern portion of the North Pacific Ocean	114
Zones of general Westerly Winds in the North Pacific	114
Prevailing Winds on the Coasts of Guatemala, Mexico, and California	115
Calms in the Eastern portion of the North Pacific	117
Currents on the Coast of California	118
Hurrricanes (compiled)	118
Hurricanes, in North and South Latitude; Rules to avoid them	120
Table showing the different months in the year, in which Hurricanes and Cyclones have been recorded in various regions	121
The Thermometer, its uses on approaching Ice or Land	122
The Barometer and Barometric Indications	122
The Aneroid Barometer	124
The Chronometer, general directions for carrying, placing and using	125
Gain or Loss of Time in circumnavigating the Globe, East or West, with examples.	126
Distance from land, by Four-point bearing	127
The Greenwich Date, Method of finding, with examples	127
Practical Rules to adjust a Sextant, Octant, or Quadrant	129
The Sun's Declination, to find and correct for any meridian, with examples	130
The Equation of Time, to find and correct for any meridian, with examples	131
Declination and Equation, short method for use on the Pacific Coast	125
Longitude at Noon, from equal altitudes of the Sun, by Chronometer, with examples	132
Longitude and Apparent Time at Sunrise and Sunset, by Chronometer, with examples	134
To find the Latitude by the Pole Star, with examples	135
The Pole Star; its meridian passages and elongations for every tenth day in 1886, in San Francisco mean time, to find latitude; and also for the use of Surveyors and Civil Engineers to find the magnetic variation	136
Correction Table for dip, refraction, semi-diameter, and parallax	137
Table of Rainfall at San Francisco, arranged in seasons from 1849 to 1887	138
Table of Seamen's Daily Wages from $5 to $100 per month	141
Burial Service at Sea	142
Telegraph Sub-marine Cables in S. F. Bay—Location and penalties for injuring	143
Special Advertisements	143 to 150

Twenty-Fifth Year of Publication.

PREFACE.

This work was first issued in 1864, in an edition of two hundred copies 24 pages, simply as a Tide-Table for the ports of San Francisco, San Diego, Astoria and Port Townsend. It supplied *one* want of navigators, but did not meet *all* their requirements. To keep pace with these, each succeeding year it has increased in *bulk*, by the addition of new matter, and in *circulation* by the growing appreciation of its merits ; until now it has reached maturity—25 years (and not yet done growing), with an average circulation of 1,500 copies of 140 pages of solid reading matter, tables, etc., all useful to navigators, and especially adapted to the needs of those on the West Coast of the United States.

The tables of almanac matter are all that are required for navigating a vessel in any part of the world. The tables for working lunar distances are omitted (that process for obtaining longitude being now nearly obsolete among navigators, owing to the present state of perfection in the construction of chronometers), but in place thereof a mass of information has been given, which makes the almanac *a full library of nautical matter*, with everything—laws, regulations, etc.—corrected up to the latest possible date before publication.

In the present issue, I have inserted the new "Dingley Shipping Act," with the latest amendments ; an article on the Winds, Calms and Currents in the eastern part of the North Pacific Ocean ; a short Rule and Example for finding the distance from land by a four-point bearing; a new, short and accurate method of finding the Longitude at Sunrise or Sunset ; a short method of finding the correction for Declination and Equation of Time on the Pacific Coast ; also the Burial Service at Sea, all of which will be very useful.

The table of distances north and south of San Francisco has been so far extended as to become a COAST DIRECTORY, giving all the prominent points on the coast, in distances carefully measured on the chart in miles, and also all the intermediate points, landings, chutes, etc., frequented by small vessels. These distances will be found quite accurate, the information having been obtained directly from those trading at the various points.

This year, the book is printed on heavy calendered paper, which will stand the use to which it is subjected without liability of being marred or defaced.

My Table of Rainfall in this city, from 1849 up to date, is given as usual, for the benefit of those interested in our grain crops, and also all others to whom it may be useful as a matter of reference.

In future years, it is the purpose of the author (so long as he remains at the helm) to spare no pains in making each succeeding edition equal, if not superior, to the preceding one, and "quite up with the times."

December, 1888. THOMAS TENNENT.

ECLIPSES IN 1889.

In the year 1889 there will be five eclipses, three of the Sun and two of the Moon.

I. A Total Eclipse of the Sun, January 1, visible generally throughout the United States and the eastern part of the North Pacific Ocean.

Eclipse begins January 1, 7 hours 3.6 min., Greenwich mean time, longitude 179 deg. 47.4 min. W., and in latitude 31 deg. 34.6 min. N.

Central Eclipse at noon, 9 hours 16 min., in longitude 137 deg. 57.3 min. W., and in latitude 36 deg. 41.4 min. N.

Eclipse ends 11 hours 30.1 min., in longitude 95 deg. 58.8 min. W., and in latitude 30 deg. 37.5 min. N.

This eclipse will be a partial one in San Francisco, beginning at 0 hours 23 min. 8 secs. P. M., and ending at 3 hours 8 min. 56 secs. Pacific Standard time.

II. A Partial Eclipse of the Moon, January 16, visible generally in Europe and North and South America. In San Francisco the moon enters penumbra at 6 hours 37.5 min. Middle of the eclipse 9 hours 29.7 min. Moon leaves penumbra at 12 hours 21.7 min. Pacific Standard time.

III. An Annular Eclipse of the Sun, June 27, visible in Southern Africa and Indian Ocean.

IV. A partial eclipse of the Moon, visible generally in Europe, Asia Africa, Australia, the Atlantic Ocean, and easterly portion of South America.

V. A total eclipse of the Sun, December 21–2, visible in Africa, South America, and the North and South Atlantic Oceans.

Morning and Evening Stars.

Venus will be Evening Star until April 30th; then Morning Star the rest of the year.

Mars will be Evening Star until June 18th; then Morning Star the rest of the year.

Jupiter will be Morning Star until June 24th; then Evening Star the rest of the year.

Saturn will be Morning Star until February 5th; then Evening Star until August 17th; then Morning Star the rest of the year.

Chronological Cycles.

Dominical Letter	F	Solar Cycle	22
Epact	28	Roman Indiction	2
Lunar Cycle or Golden Number	9	Julian Period	6602

JANUARY, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.
		A.M.	A.M.	P.M.	A.M.	A.M.	P.M.	P.M.	A.M.
Tues	1	0 11	10 29	10 09	8 29	0 49	0 01	2 20	5 16
Wed	2	1 02	11 16	10 55	9 06	1 38	0 51	3 03	6 03
Thur	3	1 51	P.M.	11 41	9 44	2 26	1 39	3 54	6 42
Frid.....	4	2 40	0 56	A.M.	10 25	3 12	2 27	4 49	7 15
Sat.....	5	3 26	1 50	0 27	11 09	large	small	5 51	7 44
Sun.....	6	large	small	1 16	11 56	4 36	4 09	7 05	8 15
Mon.....	7	4 46	4 01	2 03	P.M.	5 17	5 09	8 27	8 48
Tues	8	5 27	5 14	large	small	6 02	6 14	10 03	9 19
Wed	9	6 10	6 36	3 51	3 49	6 48	7 25	11 45	9 50
Thurs ...	10	6 49	8 00	4 41	5 26	7 39	8 52	A.M.	10 18
Frid.....	11	7 26	9 16	5 23	6 41	8 36	9 57	1 25	10 51
Sat.....	12	8 03	10 20	5 59	7 41	9 25	10 58	2 48	11 36
Sun.	13	8 37	11 15	6 35	8 28	10 09	11 50	3 47	P.M.
Mon.....	14	9 13	A.M.	7 08	9 05	10 48	A.M.	4 33	0 50
Tues	15	9 52	0 01	7 41	9 37	11 24	0 34	5 10	1 22
Wed	16	10 28	0 39	8 15	10 07	11 59	1 13	large	small
Thurs ...	17	11 03	1 15	8 49	10 34	P.M.	1 48	6 10	2 48
Frid.....	18	11 41	1 44	9 24	11 00	1 10	2 20	6 27	3 28
Sat.....	19	P.M.	2 07	10 00	11 29	1 50	2 49	6 47	4 22
Sun.....	20	1 13	2 34	10 41	A.M.	2 33	3 25	7 13	5 25
Mon.....	21	2 06	3 07	11 27	0 08	small	large	7 40	6 37
Tues	22	small	large	P.M.	0 54	4 18	4 28	8 08	7 57
Wed	23	4 30	4 25	small	large	5 23	5 08	8 35	9 08
Thurs ...	24	5 48	5 06	3 17	2 41	6 40	5 56	9 06	10 52
Frid.....	25	7 32	5 53	4 57	3 49	8 08	6 55	9 56	A.M.
Sat.....	26	9 00	6 46	6 21	4 53	9 34	7 54	10 43	0 47
Sun.....	27	10 08	7 40	7 25	5 51	10 45	8 57	11 33	2 14
Mon.....	28	11 05	8 36	8 19	6 42	11 46	9 59	P.M.	3 18
Tues	29	11 54	9 29	9 04	7 31	A.M.	11 00	1 16	4 10
Wed ...	30	A.M.	10 20	9 47	8 15	0 38	11 51	2 11	4 53
Thurs ...	31	0 39	11 10	10 29	8 56	1 23	P.M.	3 07	5 32

Sun's Semi-diameter passing the Meridian, M. 1 S. 9.8.

JANUARY, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time to be *added to* Apparent Time.	Diff. for One Hour.
	H. M.	H. M	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	7 25	5 03	5 03	18 49 20	11.0	S.22 58 5	13.0	4 0.5	1.18
2	7 25	5 03	6 10	18 53 44	11.0	22 52 39	14.1	4 28.7	1.17
3	7 25	5 04	7 20	18 58 9	11.0	22 46 46	15.3	4 56.4	1.15
4	7 25	5 05	8 28	19 2 33	11.0	22 40 26	16.4	5 23.8	1.13
5	7 26	5 06	9 33	19 6 56	11.0	22 33 39	17.5	5 50.8	1.11
6	7 26	5 06	10 37	19 11 20	11.0	22 26 25	18.6	6 17.2	1.09
7	7 26	5 07	11 38	19 15 42	10.9	22 18 44	19.7	6 43.2	1.07
8	7 26	5 08	A.M.	19 20 4	10.9	22 10 37	20.8	7 8.6	1.05
9	7 26	5 09	0 38	19 24 26	10.9	22 2 4	21.9	7 33.5	1.02
10	7 25	5 10	1 35	19 28 47	10.9	21 53 5	23.0	7 57.8	1.00
11	7 25	5 11	2 33	19 33 7	10.8	21 43 41	24.0	8 21.4	0.97
12	7 25	5 12	3 29	19 37 27	10.8	21 33 51	25.1	8 44.5	0.95
13	7 24	5 13	4 26	19 41 46	10.8	21 23 37	26.1	9 6.9	0.92
14	7 24	5 14	5 19	19 46 4	10.8	21 12 57	27.1	9 28.7	0.89
15	7 24	5 15	6 13	19 50 22	10.7	21 1 54	28.1	9 49.7	0.86
16	7 24	5 16	rises	19 54 39	10.7	20 50 26	29.1	10 10.1	0.83
17	7 23	5 17	6 00	19 58 55	10.7	20 38 34	30.1	10 29.8	0.80
18	7 23	5 18	6 59	20 3 10	10.6	20 26 19	31.1	10 48.7	0.77
19	7 23	5 19	8 03	20 7 25	10.6	20 13 41	32.1	11 6.9	0.75
20	7 22	5 20	9 07	20 11 39	10.6	20 0 40	33.0	11 24.4	0.71
21	7 22	5 21	10 11	20 15 53	10.5	19 47 17	33.9	11 41.2	0.68
22	7 21	5 22	11 15	20 20 5	10.5	19 33 32	34.8	11 57.1	0.65
23	7 20	5 23	A.M.	20 24 17	10.5	19 19 25	35.7	12 12.4	0.62
24	7 19	5 25	0 23	20 28 28	10.4	19 4 56	36.6	12 26.8	0.59
25	7 19	5 26	1 32	20 32 38	10.4	18 50 7	37.4	12 40.5	0.55
26	7 18	5 27	2 41	20 36 48	10.4	18 34 56	38.3	12 53.4	0.52
27	7 18	5 28	3 51	20 40 57	10.3	18 19 26	39.2	13 5.5	0.49
28	7 17	5 29	4 48	20 45 4	10.3	18 3 36	40.0	13 16.8	0.45
29	7 16	5 30	6 02	20 49 12	10.3	17 47 26	40.8	13 27.2	0.42
30	7 15	5 31	sets	20 53 18	10.2	17 30 57	41.6	13 36.9	0.39
31	7 14	5 33	6 04	20 57 23	10.2	17 14 10	42.4	13 45.8	0.35

Monthly Mean of Sun's Semi-diameter, 16′ 17″.6.

FEBRUARY, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.
		A.M.	A.M.	P.M.	A.M.	A.M.	P.M.	P.M.	A.M.
Frid.....	1	1 22	11 59	11 08	9 35	2 05	1 27	4 04	6 02
Sat.....	2	2 02	P.M.	11 41	10 14	2 45	2 12	5 05	6 25
Sun.....	3	large	small	A.M.	10 54	large	small	6 10	6 51
Mon.....	4	3 09	2 40	0 16	11 36	3 57	3 44	7 09	7 20
Tues	5	3 47	3 39	large	small	4 32	4 34	8 21	7 49
Wed	6	4 27	4 53	1 32	P.M.	5 10	5 33	9 45	8 14
Thur	7	5 08	6 21	2 14	3 16	5 53	6 41	11 30	8 38
Frid.....	8	5 50	7 57	3 16	5 36	6 46	8 02	A.M.	9 16
Sat.....	9	6 32	9 16	4 23	7 01	7 41	9 25	1 21	10 01
Sun.....	10	7 14	10 15	5 20	7 46	8 36	10 36	2 46	10 49
Mon.....	11	8 02	10 58	6 07	8 18	9 28	11 29	3 33	11 32
Tues	12	8 47	11 30	6 47	8 43	10 22	A.M.	large	small
Wed	13	9 29	11 59	7 25	9 08	11 01	0 12	4 31	P.M.
Thur	14	10 10	A.M.	8 03	9 31	11 43	0 47	4 55	2 00
Frid	15	10 50	0 26	8 39	9 56	P.M.	1 19	5 09	2 55
Sat.....	16	11.32	0 45	9 14	10 18	1 02	1 50	5 26	3 50
Sun.....	17	P.M.	1 09	9 52	10 49	1 42	2 19	5 48	4 46
Mon.....	18	1 06	1 39	10 32	11 24	small	large	6 13	5 46
Tues.....	19	small	large	11 17	A.M.	3 15	3 19	6 38	6 52
Wed.....	20	2 57	2 47	P.M.	0 06	4 09	3 53	7 03	8 07
Thurs....	21	4 15	3 27	small	large	5 11	4 36	7 42	9 30
Frid.....	22	5 54	4 16	3 00	1 54	6 28	5 23	8 26	11 12
Sat.....	23	7 40	5 15	5 02	3 08	7 59	6 19	9 11	A.M.
Sun.....	24	8 58	6 19	6 25	4 28	9 28	7 27	10 03	0 46
Mon.....	25	9 55	7 22	7 19	5 37	10 37	8 38	11 02	2 01
Tues	26	10 42	8 26	8 05	6 33	11 31	9 47	small	large
Wed	27	11 24	9 23	8 45	7 23	A.M.	10 49	P.M.	3 35
Thur	28	A.M.	10 11	9 21	8 09	0 17	11 42	2 30	4 08

Sun's Semi-diameter passing the Meridian, M. 1. S. 6.6.

FEBRUARY, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time to be *added to* Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S	S.	° ′ ″	″	M. S.	S.
1	7 14	5 34	7 12	21 1 28	10.2	S.16 57 4	43.1	13 53.8	0.32
2	7 13	5 35	8 19	21 5 32	10.1	16 39 41	43.8	14 1.0	0.28
3	7 12	5 36	9 22	21 9 35	10.1	16 22 0	44.5	14 7.4	0.25
4	7 11	5 37	10 23	21 13 37	10.1	16 4 2	45.2	14 13.0	0.21
5	7 10	5 38	11 24	21 17 38	10.0	15 45 48	45.9	14 17.7	0.18
6	7 09	5 39	A.M.	21 21 38	10.0	15 27 18	46 6	14 21.6	0.15
7	7 07	5 41	0 23	21 25 38	10.0	15 8 32	47.2	14 24.6	0.11
8	7 06	5 42	1 20	21 29 37	9.9	14 49 30	47.9	14 26.9	0.08
9	7 05	5 43	2 16	21 33 35	9.9	14 30 14	48.5	14 28.3	0.04
10	7 04	5 44	3 10	21 37 32	9.9	14 10 44	49.1	14 29.0	0.01
11	7 03	5 45	4 05	21 41 28	9.8	13 50 59	49.6	14 28.8	0.02
12	7 02	5 46	4 56	21 45 24	9.8	13 31 1	50.2	14 27.9	0.05
13	7 01	5 47	rises	21 49 19	9.8	13 10 50	50.7	14 26.2	0.08
14	7 00	5 48	4 49	21 53 13	9.7	12 50 25	51.3	14 23.7	0.12
15	6 59	5 49	5 52	21 57 6	9.7	12 29 49	51.8	14 20.6	0.15
16	6 57	5 50	6 58	22 0 59	9.7	12 9 1	52.2	14 16.7	0.18
17	6 56	5 51	8 02	22 4 51	9.6	11 48 1	52.7	14 12.1	0.20
18	6 55	5 52	9 07	22 8 42	9.6	11 26 49	53.2	14 6.8	0.23
19	6 54	5 53	10 16	22 12 33	9.6	11 5 28	53.6	14 0.8	0.26
20	6 53	5 54	11 23	22 16 23	9.6	10 43 55	54.1	13 54.2	0.29
21	6 52	5 55	A.M.	22 20 12	9.5	10 22 13	54.5	13 46.9	0.31
22	6 50	5 56	0 33	22 24 1	9.5	10 0 21	54.8	13 39.1	0.34
23	6 49	5 57	1 41	22 27 49	9.5	9 38 20	55.2	13 30.6	0.36
24	6 47	5 58	2 48	22 31 36	9.5	9 16 10	55.6	13 21.6	0.39
25	6 46	5 00	3 50	22 35 23	9.4	8 53 52	55.9	13 11.9	0.41
26	6 45	5 01	4 48	22 39 9	9.4	8 31 26	56.2	13 1.8	0.44
27	6 43	5 02	5 36	22 42 55	9.4	8 8 52	56.6	12 51.1	0.46
28	6 42	5 03	6 20	22 46 41	9.4	7 46 11	56.8	12 39.8	0.48

Monthly Mean of Sun's Semi-diameter, 16′ 13.5.

MARCH, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.
		A.M.	A.M.	P.M.	A.M.	A.M.	P.M.	P.M.	A.M.
Frid.	1	0 02	11 07	9 55	8 49	0 58	0 31	3 31	4 38
Sat.	2	0 38	11 57	10 24	9 28	1 37	1 16	4 28	5 01
Sun.	3	large	small	10 51	10 03	large	small	5 20	5 26
Mon.	4	1 38	P.M.	11 15	10 40	2 43	2 38	6 15	5 51
Tues.	5	2 10	2 24	11 52	11 21	3 14	3 20	6 59	6 17
Wed	6	2 43	3 24	A.M.	11 52	3 47	4 06	8 03	6 40
Thur.	7	3 16	4 41	large	small	4 26	4 57	9 17	7 13
Frid.	8	3 52	6 20	0 56	P.M.	5 02	6 00	11 09	7 46
Sat.	9	4 38	7 59	1 47	5 14	5 48	7 20	A.M.	8 21
Sun.	10	5 36	9 05	3 22	6 56	6 41	8 48	0 51	9 00
Mon.	11	6 42	9 46	4 46	7 28	7 45	9 58	large	small
Tues.	12	7 36	10 17	5 44	7 46	8 50	10 50	2 36	11 00
Wed.	13	8 28	10 41	6 32	8 05	9 49	11 31	3 02	P.M.
Thur.	14	9 13	11 02	7 13	8 26	10 40	A.M.	3 21	1 20
Frid.	15	9 57	11 22	7 51	8 49	11 26	0 05	3 37	2 23
Sat.	16	10 42	11 46	8 27	9 12	P.M.	0 40	3 59	3 15
Sun.	17	11 26	A.M.	9 04	9 40	0 52	1 12	4 21	4 10
Mon.	18	P.M.	0 15	9 42	10 16	small	large	4 44	4 57
Tues.	19	small	large	10 23	10 54	2 21	2 14	5 09	5 46
Wed.	20	1 59	1 20	small	large	3 10	2 47	5 49	6 50
Thur.	21	3 06	1 59	P.M.	A.M.	4 03	3 23	6 21	7 59
Frid.	22	4 29	2 47	1 17	0 15	5 07	4 03	6 54	9 17
Sat.	23	6 15	3 42	3 10	1 14	6 25	4 52	7 35	10 52
Sun.	24	7 42	4 45	5 08	2 35	7 53	5 54	8 26	A.M.
Mon.	25	8 42	5 57	6 15	4 06	9 14	7 09	small	large
Tues.	26	9 30	7 12	7 01	5 21	10 19	8 29	11 03	1 21
Wed.	27	10 10	8 20	7 40	6 21	11 07	9 40	P.M.	2 04
Thur.	28	10 45	9 17	8 16	7 11	11 49	10 41	1 44	2 38
Fri.	29	large	small	8 47	7 56	A.M.	11 33	2 49	3 06
Sat.	30	11 46	11 05	9 14	8 36	large	small	3 43	3 33
Sun.	31	A.M.	11 51	9 47	9 16	1 03	P.M.	4 27	3 58

Sun's Semi-diameter passing the Meridian, M. 1 S. 4.6.

MARCH, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of time to be *added to* Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	6 40	6 05	6 00	22 50 25	9.4	S. 7 23 23	57.1	12 28.1	0.50
2	6 38	6 06	7 05	22 54 10	9.3	7 0 29	57.4	12 15.8	0.52
3	6 37	6 06	8 08	22 57 53	9.3	6 37 29	57.6	12 3.0	0.54
4	6 36	6 07	9 09	23 1 37	9.3	6 14 23	57.8	11 49.8	0.56
5	6 34	6 08	10 09	23 5 20	9.3	5 51 13	58.0	11 36.2	0.58
6	6 32	6 09	11 08	23 9 2	9.3	5 27 57	58.2	11 22.0	0.60
7	6 31	6 10	A.M.	23 12 44	9.2	5 4 38	58.4	11 7.5	0.61
8	6 30	6 11	0 04	23 16 26	9.2	4 41 14	58.5	10 52.6	0.63
9	6 29	6 12	0 59	23 20 7	9.2	4 17 47	58.7	10 37.3	0.64
10	6 27	6 13	1 55	23 23 48	9.2	3 54 17	58.8	10 21.6	0.66
11	6 25	6 14	2 47	23 27 28	9.2	3 30 44	58.9	10 5.6	0.67
12	6 24	6 15	3 36	23 31 8	9.2	3 7 9	59.0	9 49.2	0.69
13	6 22	6 16	4 21	23 34 48	9.2	2 43 31	59.1	9 32.6	0.70
14	6 21	6 17	5 01	23 38 28	9.1	2 19 52	59.1	9 15.7	0.71
15	6 20	6 18	rises	23 42 7	9.1	1 56 12	59.2	8 58.5	0.72
16	6 18	6 19	5 47	23 45 46	9.1	1 32 31	59.2	8 41.1	0.73
17	6 17	6 19	6 54	23 49 25	9.1	1 8 49	59.2	8 23.5	0.74
18	6 16	6 20	8 03	23 53 4	9.1	0 45 8	59.2	8 5.7	0.74
19	6 14	6 21	9 12	23 56 42	9.1	S. 0 21 26	59.2	7 47.8	0.75
20	6 13	6 22	10 22	0 0 21	9.1	N. 0 2 15	59.2	7 29.7	0.75
21	6 11	6 23	11 33	0 3 59	9.1	0 25 56	59.2	7 11.5	0.76
22	6 09	6 24	A.M.	0 7 37	9.1	0 49 35	59.1	6 53.2	0.76
23	6 08	6 24	0 42	0 11 15	9.1	1 13 13	59.0	6 34 9	0.77
24	6 06	6 25	1 45	0 14 54	9.1	1 36 49	59.0	6 16.5	0.77
25	6 04	6 26	2 45	0 18 32	9.1	2 0 23	58.9	5 58.1	0.77
26	6 03	6 27	3 34	0 22 10	9.1	2 23 55	58.8	5 39.7	0.77
27	6 01	6 28	4 17	0 25 48	9.1	2 47 23	58.6	5 21.3	0.77
28	6 00	6 29	4 56	0 29 26	9.1	3 10 49	58.5	5 2.9	0.76
29	5 58	6 30	5 29	0 33 4	9.1	3 34 10	58.3	4 44.6	0.76
30	5 56	6 31	sets	0 36 42	9.1	3 57 28	58.1	4 26.4	0.76
31	5 55	6 33	6 52	0 40 21	9.1	4 20 41	58.0	4 8.2	0.76

Monthly Mean of Sun's Semi-diameter, 16′ 6.7″.

APRIL, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Small.	Large.
		A.M.	P.M.	P.M.	A.M.	A.M.	P.M.	P.M.	A.M.
Mon.....	1	0 15	0 35	10 13	9 53	1 34	1 42	5 16	4 25
Tues	2	0 43	1 25	10 33	10 23	2 04	2 22	6 09	5 01
Wed	3	1 12	2 26	10 52	10 56	2 33	3 02	7 01	5 29
Thur	4	1 44	3 19	11 09	11 41	3 01	3 44	7 57	5 49
Frid.....	5	2 17	4 41	11 31	P.M.	3 32	4 27	9 04	6 11
Sat.....	6	2 55	6 25	A.M.	2 11	4 03	5 30	10 22	6 28
Sun......	7	3 43	7 45	0 06	3 45	4 44	6 42	large	small
Mon.....	8	4 44	8 30	1 41	5 11	5 38	8 01	A.M.	7 40
Tues	9	5 55	9 00	3 51	6 23	6 51	9 10	0 33	8 57
Wed	10	7 03	9 22	5 10	7 01	8 06	9 58	1 05	10 39
Thur	11	8 05	9 40	6 06	7 19	small	large	1 33	P.M.
Frid	12	small	large	small	large	10 18	11 20	2 00	1 31
Sat	13	9 49	10 28	7 36	8 09	11 11	11 55	2 25	2 31
Sun......	14	10 31	10 56	8 17	8 40	11 59	A.M.	2 50	3 18
Mon.....	15	11 19	11 31	8 58	9 08	P.M.	0 28	3 20	4 10
Tues	16	P.M.	A.M.	9 34	9 39	1 33	1 01	3 53	5 06
Wed	17	1 10	0 05	10 20	10 13	2 21	1 35	small	large
Thur	18	2 13	0 40	11 11	10 51	3 12	2 11	4 50	7 06
Frid.....	19	3 25	1 21	P.M.	11 37	4 08	2 51	5 24	8 06
Sat.....	20	4 52	2 10	1 38	A.M.	5 11	3 35	6 03	9 19
Sun......	21	6 17	3 08	3 30	0 36	6 24	4 29	6 50	10 30
Mon.....	22	7 20	4 22	4 59	1 58	7 46	5 35	7 56	11 30
Tues.....	23	8 11	5 24	large	small	8 51	6 56	9 31	A.M.
Wed.....	24	large	small	6 34	4 56	large	small	11 16	0 15
Thur.....	25	9 23	8 17	7 07	6 03	10 33	9 33	P.M.	0 55
Frid.....	26	9 56	9 19	7 36	6 57	11 14	10 34	1 56	1 29
Sat.....	27	10 27	10 14	8 10	7 45	11 51	11 25	1 54	2 00
Sun......	28	10 55	11 02	9 39	8 27	A.M.	P.M.	3 52	2 28
Mon.....	29	11 27	11 54	9 02	9 06	0 24	0 53	4 46	3 08
Tues	30	11 56	P.M.	9 23	9 46	0 52	1 32	5 36	3 39

Sun's Semi-diameter passing the Meridian, M. S. 1 5.1.

APRIL, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time to be *added to* / *subtracted* from Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 53	6 34	7 55	0 43 59	9.1	N. 4 43 50	57.7	3 50 2	0.75
2	5 52	6 34	8 55	0 47 38	9.1	5 6 54	57.5	3 32.2	0.75
3	5 50	6 35	9 54	0 51 16	9.1	5 29 52	57.3	3 14.4	0.74
4	5 49	6 36	10 51	0 54 55	9.1	5 52 44	57.1	2 56.7	0.73
5	5 47	6 37	11 47	0 58 34	9.1	6 15 31	56.8	2 39.2	0.73
6	5 46	6 38	A.M.	1 2 13	9.1	6 38 10	56.5	2 21.8	0.72
7	5 45	6 39	0 39	1 5 33	9.1	7 0 43	56.2	2 4.7	0.71
8	5 43	6 39	1 29	1 9 32	9.2	7 23 9	55.9	1 47.7	0.70
9	5 42	6 40	2 16	1 13 12	9.2	7 45 27	55.6	1 31.0	0.69
10	5 40	6 41	2 56	1 16 52	9.2	8 7 37	55.2	1 14.6	0.68
11	5 39	6 42	3 33	1 20 32	9.2	8 29 39	54.9	0 58.4	0.67
12	5 38	6 43	4 07	1 24 13	9.2	8 51 32	54.5	0 42.4	0.66
13	5 36	6 44	rises	1 27 54	9.2	9 13 16	54.1	0 26.8	0.64
14	5 34	6 45	5 42	1 31 35	9.2	9 34 51	53.8	0 11.5	0.63
15	5 32	6 46	6 53	1 35 17	9.2	9 56 17	53.4	0 3.5	0.62
16	5 31	6 46	8 06	1 38 59	9.3	10 17 33	52.9	0 18.1	0.60
17	5 30	6 47	9 19	1 42 41	9.3	10 38 38	52.5	0 32.3	0.58
18	5 29	6 48	10 29	1 46 24	9.3	10 59 33	52.1	0 46.1	0.57
19	5 27	6 49	11 38	1 50 7	9.3	11 20 17	51.6	0 59.5	0.55
20	5 26	6 50	A.M.	1 53 50	9.3	11 40 51	51.1	1 12.5	0.53
21	5 25	6 51	0 41	1 57 34	9.3	12 1 13	50.7	1 25.0	0.51
22	5 23	6 52	1 34	2 1 19	9.4	12 21 23	50.2	1 37.1	0.49
23	5 22	6 53	2 19	2 5 4	9.4	12 41 21	49.6	1 48.7	0.47
24	5 21	6 54	2 58	2 8 49	9.4	13 1 6	49.1	1 59.8	0.45
25	5 20	6 55	3 33	2 12 35	9.4	13 20 39	48.6	2 10.4	0.43
26	5 18	6 56	4 04	2 16 21	9.4	13 39 59	48.1	2 20.5	0.41
27	5 17	6 57	4 31	2 20 8	9.5	13 59 6	47.5	2 30.1	0.39
28	5 16	6 58	sets	2 23 56	9.5	14 17 59	46.9	2 39.2	0.37
29	5 15	6 59	6 46	2 27 44	9.5	14 36 38	46.3	2 47.8	0.34
30	5 14	7 00	7 45	2 31 32	9.5	14 55 2	45.7	2 55.8	0.32

Monthly Mean of Sun's Semi-diameter, 15′ 58″.1.

MAY, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Smal	Small.	Large.
			P.M.	P.M.	A.M.	A.M.	P.M.	P.M.	A.M.
Wed	1	A.M.	1 36	9 42	10 24	1 22	2 10	6 25	4 01
Thur ...	2	0 25	2 32	10 01	11 03	1 50	2 49	7 12	4 21
Frid. ...	3	0 54	3 37	10 22	11 51	2 15	3 30	large	small
Sat.....	4	1 23	4 52	10 51	P.M.	2 43	4 12	8 53	4 56
Sun.	5	1 55	6 04	11 31	3 19	3 16	5 00	9 46	5 13
Mon.....	6	2 41	6 56	A.M.	4 41	3 57	5 57	10 34	5 45
Tues.....	7	3 44	7 25	0 42	5 09	4 53	6 59	11 16	6 46
Wed.....	8	small	large	small	large	small	large	11 52	8 41
Thur.....	9	6 28	8 11	4 29	5 55	7 28	8 55	A.M.	10 48
Frid.....	10	7 43	8 38	5 35	6 24	8 48	9 42	0 22	P.M.
Sat.....	11	8 44	9 07	6 31	6 57	9 54	10 27	0 51	1 27
Sun.	12	9 32	9 35	7 19	7 30	10 52	11 08	1 17	2 26
Mon.....	13	10 30	10 14	8 06	8 03	11 47	11 47	1 59	3 27
Tues.....	14	11 27	10 51	8 50	8 36	P.M.	A.M.	2 29	4 25
Wed.....	15	P.M.	11 30	9 37	9 12	1 29	0 25	2 58	5 23
Thur.....	16	1 28	A.M.	10 26	9 49	2 19	1 05	3 28	6 22
Frid.....	17	2 33	0 09	11 21	10 30	3 11	1 46	small	large
Sat.....	18	3 43	0 54	P.M.	11 16	4 06	2 31	4 41	8 15
Sun......	19	4 51	1 46	1 44	A.M.	5 03	3 20	5 28	9 08
Mon.....	20	5 52	2 47	3 11	0 14	6 04	4 16	6 26	9 56
Tues.....	21	large	small	4 22	1 30	7 06	5 25	7 47	10 40
Wed.....	22	7 24	5 31	large	small	large	small	9 36	11 21
Thur.	23	8 01	6 53	5 53	4 29	8 57	8 03	11 16	11 57
Fri.....	24	8 38	8 02	6 27	5 40	9 44	9 16	P.M.	A.M.
Sat.....	25	9 11	9 08	6 59	6 40	10 32	10 18	2 05	0 27
Sun......	26	9 42	10 08	7 30	7 30	11 12	11 13	3 10	0 58
Mon.....	27	10 11	11 05	7 59	8 18	11 46	P.M.	4 08	1 39
Tues.....	28	10 42	11 58	8 23	9 04	A.M.	0 44	5 02	2 13
Wed.....	29	11 15	P.M.	8 48	9 46	0 16	1 24	5 52	2 38
Thur	30	11 46	1 43	9 11	10 29	0 44	2 03	6 40	3 02
Frid. ...	31	A.M.	2 41	9 35	11 13	1 11	2 41	7 20	3 23

Sun's Semi-diameter passing the Meridian, M. 1. S. 7.1.

MAY, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of time to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 13	7 01	8 43	2 35 21	9.6	N.15 13 12	45.1	3 3.3	0.30
2	5 12	7 02	9 40	2 39 11	9.6	15 31 6	44.5	3 10.3	0.28
3	5 10	7 03	10 34	2 43 1	9.6	15 48 46	43.8	3 16.7	0.26
4	5 09	7 04	11 24	2 46 52	9.6	16 6 9	43.1	3 22.6	0.23
5	5 08	7 04	A.M.	2 50 43	9.6	16 23 17	42.5	3 27.9	0.21
6	5 07	7 05	0 12	2 54 34	9.7	16 40 8	41.8	3 32.7	0.19
7	5 06	7 06	0 55	2 58 27	9.7	16 56 42	41.1	3 37.0	0.16
8	5 05	7 07	1 32	3 2 20	9.7	17 13 0	40.4	3 40.7	0.14
9	5 04	7 08	2 07	3 6 13	9.7	17 29 0	39.6	3 43.8	0.12
10	5 03	7 09	2 38	3 10 7	9.8	17 44 43	38.9	3 46.4	0.09
11	5 02	7 10	3 10	3 14 2	9.8	18 0 7	38.1	3 48.4	0.07
12	5 01	7 10	3 39	3 17 57	9.8	18 15 14	37.4	3 49.9	0.05
13	5 00	7 11	rises	3 21 52	9.8	18 30 2	36.6	3 50.8	0.02
14	4 59	7 12	6 54	3 25 49	9.9	18 44 32	35.8	3 51.1	0.00
15	4 59	7 13	8 09	3 29 45	9.9	18 58 42	35.0	3 50.8	0.02
16	4 58	7 14	9 22	3 33 43	9.9	19 12 33	34.2	3 50.0	0.05
17	4 57	7 15	10 28	3 37 41	9.9	19 26 5	33.4	3 48.6	0.07
18	4 56	7 16	11 28	3 41 39	9.9	19 39 17	32.6	3 46.7	0.09
19	4 55	7 17	A.M.	3 45 38	10.0	19 52 9	31.7	3 44.2	0.12
20	4 54	7 18	0 18	3 49 38	10.0	20 4 41	30.9	3 41.1	0.14
21	4 53	7 18	1 01	3 53 38	10.0	20 16 56	30.0	3 37.5	0.16
22	4 52	7 19	1 36	3 57 39	10.0	20 28 44	29.2	3 33.3	0.19
23	4 51	7 20	2 08	4 1 40	10.1	20 40 13	28.3	3 28.5	0.21
24	4 51	7 21	2 36	4 5 42	10.1	20 51 22	27.4	3 23.3	0.23
25	4 50	7 22	3 03	4 9 44	10.1	21 2 9	26.5	3 17.5	0.25
26	4 50	7 23	3 29	4 13 47	10.1	21 12 35	25.6	3 11.2	0.27
27	4 49	7 23	3 57	4 17 51	10.2	21 22 39	24.7	3 4.4	0.29
28	4 49	7 24	sets	4 21 54	10.2	21 32 20	23.8	2 57.1	0.31
29	4 48	7 25	7 33	4 25 59	10.2	21 41 40	22.8	2 49.4	0.33
30	4 48	7 26	8 29	4 30 4	10.2	21 50 36	21.9	2 41.2	0.35
31	4 48	7 26	9 20	4 34 9	10.2	21 59 10	20.9	2 32.6	0.37

Monthly Mean of Sun's Semi-diameter, 15′ 51″.1.

JUNE, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
		A.M.	P.M.	P.M.	A.M.	A.M.	P.M.	P.M.	A.M.
Sat.....	1	0 13	3 31	9 51	11 55	1 39	3 17	7 56	3 41
Sun......	2	0 43	4 20	10 36	P.M.	2 08	3 52	8 30	4 04
Mon.....	3	1 21	4 59	11 20	1 34	2 44	4 33	9 06	4 34
Tues	4	2 08	5 31	A.M.	2 31	3 28	5 19	9 42	5 30
Wed	5	3 11	6 05	0 23	3 25	small	large	10 15	6 57
Thur	6	small	large	small	large	5 34	6 59	10 47	8 50
Frid.....	7	5 57	7 11	3 35	4 57	6 53	7 50	11 16	10 40
Sat.....	8	7 15	7 45	5 01	5 35	8 13	8 47	11 43	P.M.
Sun......	9	8 23	8 18	6 06	6 15	9 29	9 39	A.M.	1 33
Mon.....	10	9 35	8 59	7 06	6 56	10 36	10 26	0 26	2 45
Tues	11	10 41	9 41	8 00	7 36	11 37	11 12	1 05	3 50
Wed .. .	12	11 43	10 23	8 52	8 16	P.M.	11 58	1 38	4 47
Thur	13	P.M.	11 07	9 43	8 55	1 24	A.M.	2 13	5 43
Frid....	14	1 39	11 52	10 33	9 37	2 15	0 43	small	large
Sat.....	15	2 34	A.M.	11 26	10 19	3 05	1 29	3 36	7 18
Sun......	16	3 28	0 40	P.M.	11 04	3 55	2 17	4 26	7 58
Mon.....	17	4 19	1 33	1 21	11 57	4 42	3 08	5 22	8 35
Tues	18	5 05	2 36	2 22	A.M.	5 32	4 04	6 28	9 12
Wed	19	large	small	3 24	0 59	large	small	7 56	9 50
Thur	20	6 33	5 11	large	small	7 13	6 18	9 32	10 25
Frid.....	21	7 15	6 28	5 07	3 53	8 04	7 34	11 15	10 57
Sat.....	22	7 54	7 47	5 49	5 17	9 00	8 50	P.M.	11 26
Sun......	23	8 30	9 02	6 23	6 27	9 48	9 59	2 13	A.M.
Mon.....	24	9 01	10 08	6 54	7 26	10 30	10 59	3 23	0 02
Tues.....	25	9 34	11 05	7 25	8 19	11 09	11 51	4 18	0 45
Wed.....	26	10 08	11 59	7 55	9 04	11 44	P.M.	5 07	1 20
Thur.....	27	10 43	P.M.	8 24	9 46	A.M.	1 19	5 53	1 49
Frid.....	28	11 15	1 34	8 52	10 23	0 14	1 56	large	small
Sat.....	29	11 47	2 17	9 23	10 57	0 43	2 30	7 00	2 43
Sun......	30	A.M.	2 53	9 56	11 30	1 14	3 01	7 24	3 14

Sun's Semi-diameter passing the Meridian, M. 1 S. 8.6.

JUNE, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of time to be *subtracted* from / *added to* Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	4 48	7 27	10 10	4 38 14	10.2	N.22 7 21	20.0	2 23.6	0.38
2	4 48	7 27	10 55	4 42 20	10.3	22 15 9	19.0	2 14.2	0.40
3	4 47	7 28	11 34	4 46 27	10.3	22 22 34	18.0	2 4.4	0.41
4	4 47	7 28	A.M	4 50 33	10.3	22 29 35	17.0	1 54.3	0.43
5	4 47	7 29	0 09	4 54 40	10.3	22 36 12	16.1	1 43.9	0.44
6	4 47	7 29	0 39	4 58 48	10.3	22 42 26	15.1	1 33.2	0.45
7	4 47	7 30	1 08	5 2 55	10.3	22 48 16	14.1	1 22.2	0.46
8	4 47	7 30	1 39	5 7 3	10.3	22 53 41	13.1	1 10.9	0.47
9	4 47	7 31	2 10	5 11 11	10.3	22 58 43	12.1	0 59.4	0.48
10	4 47	7 31	2 42	5 15 19	10.3	23 3 20	11.0	0 47.7	0.49
11	4 47	7 32	3 18	5 19 28	10.4	23 7 33	10 0	0 35.7	0.50
12	4 47	7 32	rises	5 23 37	10.4	23 11 21	9.0	0 23.6	0.51
13	4 47	7 33	8 08	5 27 46	10.4	23 14 45	8.0	0 11.2	0.52
14	4 47	7 33	9 13	5 31 55	10.4	23 17 45	7.0	0 01.2	0.52
15	4 47	7 33	10 10	5 36 4	10.4	23 20 19	5.9	0 13.8	0.53
16	4 47	7 34	10 57	5 40 13	10.4	23 22 29	4.9	0 26.5	0.53
17	4 47	7 34	11 36	5 44 23	10.4	23 24 15	3.9	0 39.4	0.54
18	4 47	7 34	A.M.	5 48 32	10.4	23 25 36	2.8	0 52.3	0.54
19	4 47	7 35	0 10	5 52 42	10.4	23 26 31	1.8	1 5.2	0.54
20	4 47	7 35	0 39	5 56 51	10.4	23 27 3	0.8	1 18.2	0.54
21	4 48	7 35	1 07	6 1 1	10.4	23 27 9	0.2	1 31.2	0.54
22	4 48	7 35	1 33	6 5 10	10.4	23 26 51	1.3	1 44.2	0.54
23	4 48	7 35	2 00	6 9 20	10.4	23 26 7	2.3	1 57.2	0.54
24	4 48	7 35	2 29	6 13 29	10.4	23 24 59	3.3	2 10.1	0.53
25	4 49	7 35	3 00	6 17 39	10.4	23 23 27	4.4	2 22.8	0.53
26	4 49	7 35	3 37	6 21 48	10.4	23 21 29	5.4	2 35.5	0.52
27	4 49	7 35	sets	6 25 57	10.4	23 19 7	6.4	2 48.1	0.52
28	4 50	7 35	8 07	6 30 6	10.4	23 16 21	7.4	3 0.4	0.51
29	4 50	7 35	8 53	6 34 15	10.4	23 13 10	8.5	3 12.6	0.50
30	4 50	7 35	9 34	6 38 24	10.3	23 9 34	9.	3 24.6	0.49

Monthly Mean of Sun's Semi-diameter, 15′ 47″.

JULY, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
		A.M.	P.M.	P.M.	A.M.	A.M.	P.M.	P.M.	A.M.
Mon.....	1	0 21	3 21	10 34	11 56	1 47	3 31	7 42	3 54
Tues	2	1 03	3 48	11 18	P.M.	2 26	4 05	8 17	4 45
Wed	3	1 51	4 21	A.M.	1 13	small	large	8 46	5 52
Thur	4	small	large	0 12	2 06	4 05	5 22	9 13	7 20
Frid.....	5	4 09	5 35	small	large	5 09	6 07	9 41	8 50
Sat.....	6	5 34	6 14	2 57	3 57	6 24	6 58	10 09	10 22
Sun......	7	7 03	6 54	4 32	4 52	7 46	7 59	10 55	P.M.
Mon.....	8	8 27	7 38	5 54	5 44	9 09	8 55	11 39	1 42
Tues	9	9 42	8 28	7 01	6 33	10 24	9 51	A.M.	2 57
Wed	10	10 46	9 17	7 59	7 18	11 29	10 45	0 22	3 57
Thur	11	11 43	10 06	8 49	8 04	P.M.	11 37	1 04	4 52
Frid.....	12	P.M.	10 55	9 37	8 46	1 15	A.M.	1 50	5 36
Sat.....	13	1 23	11 43	10 24	9 28	2 02	0 29	small	large
Sun......	14	2 08	A.M.	11 09	10 11	2 48	1 17	3 34	6 52
Mon.....	15	2 51	0 33	11 53	10 54	3 32	2 05	4 32	7 19
Tues	16	3 31	1 28	P.M.	11 40	4 13	2 54	5 32	7 50
Wed	17	4 12	2 25	1 20	A.M.	large	small	6 42	8 22
Thur	18	large	small	2 13	0 32	5 37	4 43	8 01	8 54
Frid.....	19	5 41	4 43	large	small	6 20	5 47	9 28	9 25
Sat.....	20	6 24	6 07	4 06	3 16	7 13	6 57	11 08	9 55
Sun......	21	7 05	7 36	5 00	5 02	8 11	8 17	P.M.	10 30
Mon.....	22	7 47	8 58	5 45	6 30	9 03	9 36	2 19	11 15
Tues.....	23	8 25	10 07	6 25	7 35	9 54	10 44	3 25	A.M.
Wed.....	24	9 04	11 02	6 59	8 24	10 38	11 39	4 13	0 01
Thur.....	25	9 42	11 48	7 33	9 00	11 16	P.M.	4 54	0 40
Frid.....	26	10 22	P.M.	8 07	9 29	11 52	1 01	large	small
Sat.....	27	10 56	1 00	8 42	9 57	A.M.	1 38	5 55	1 53
Sun......	28	11 33	1 30	9 14	10 22	0 25	2 08	6 13	2 35
Mon.....	29	A.M.	1 51	9 48	10 45	0 59	2 34	6 30	3 22
Tues	30	0 10	2 14	10 26	11 06	1 36	3 01	6 53	4 15
Wed	31	0 54	2 42	11 07	11 37	2 16	3 31	7 17	5 11

Sun's Semi-diameter passing the Meridian, M. 1 S. 7.7.

JULY, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time to be *added to* Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	4 51	7 35	10 11	6 42 32	10.3	N.23 5 34	10.5	3 36.3	0.48
2	4 51	7 35	10 43	6 46 40	10.3	23 1 10	11.5	3 47.7	0.47
3	4 52	7 35	11 12	6 50 48	10.3	22 56 22	12.5	3 58.8	0.46
4	4 52	7 35	11 42	6 54 55	10.3	22 51 9	13.5	4 9.6	0.44
5	4 53	7 35	A.M.	6 59 2	10.3	22 45 33	14.5	4 20.1	0.43
6	4 53	7 35	0 10	7 3 9	10.3	22 39 33	15.5	4 30.2	0.41
7	4 54	7 35	0 40	7 7 15	10.3	22 33 10	16.5	4 39.9	0.40
8	4 54	7 34	1 23	7 11 21	10.2	22 26 23	17.4	4 49.3	0.38
9	4 55	7 34	1 51	7 15 26	10.2	22 19 13	18.4	4 58.2	0.36
10	4 55	7 34	2 37	7 19 31	10.2	22 11 40	19.3	5 6.7	0.34
11	4 56	7 34	3 28	7 23 36	10.2	22 3 44	20.3	5 14.7	0.33
12	4 56	7 33	rises	7 27 40	10.2	21 55 25	21.2	5 22.3	0.31
13	4 57	7 33	8 46	7 31 44	10.1	21 46 44	22.2	5 29.4	0.29
14	4 58	7 32	9 30	7 35 47	10.1	21 37 40	23.1	5 36.0	0.27
15	4 59	7 32	10 07	7 39 50	10.1	21 28 15	24.0	5 42.2	0.25
16	5 00	7 31	10 40	7 43 52	10.1	21 18 27	24.9	5 47.8	0.23
17	5 01	7 30	11 10	7 47 54	10.1	21 8 18	25.8	5 53.0	0.20
18	5 01	7 30	11 37	7 51 55	10.0	20 57 47	26.7	5 57.6	0.18
19	5 02	7 29	A.M.	7 55 56	10.0	20 46 55	27.6	6 1.8	0.16
20	5 02	7 29	0 05	7 59 56	10.0	20 35 42	28.5	6 5.3	0.14
21	5 03	7 28	0 33	8 3 56	10.0	20 24 8	29.3	6 8.4	0.12
22	5 04	7 27	0 53	8 7 55	9.9	20 12 13	30.2	6 10.9	0.09
23	5 05	7 27	1 35	8 11 53	9.9	19 59 58	31.0	6 12.9	0.07
24	5 06	7 26	2 16	8 15 51	9.9	19 47 24	31.9	6 14.3	0.05
25	5 07	7 25	3 02	8 19 48	9.9	19 34 29	32.7	6 15.1	0.02
26	5 08	7 24	sets	8 23 45	9.9	19 21 15	33.5	6 15.3	0.00
27	5 09	7 23	7 34	8 26 41	9.8	19 7 41	34.3	6 15.0	0.03
28	5 09	7 22	8 11	8 31 37	9.8	18 53 49	35.1	6 14.0	0.05
29	5 10	7 21	8 45	8 35 32	9.8	18 39 37	35.8	6 12.5	0.08
30	5 11	7 20	9 15	8 39 26	9.8	18 25 8	36.6	6 10.3	0.10
31	5 12	7 19	9 45	8 43 20	9.7	18 10 20	37.4	6 7.5	0.13

Monthly Mean of Sun's Semi-diameter, 15′ 46″.8.

AUGUST, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Large.	Small.
		A.M.	P.M.	P.M.	P.M.	A.M.	P.M.	P.M.	A.M.
Thur.....	1	1 46	3 16	11 56	0 18	3 01	4 02	7 42	6 18
Frid.....	2	2 45	3 53	A.M.	1 02	3 52	4 39	8 07	7 32
Sat.....	3	3 55	4 33	1 05	1 53	4 52	5 24	8 37	8 45
Sun......	4	5 08	5 19	2 29	3 01	6 02	6 18	9 24	10 10
Mon....	5	6 54	6 13	4 21	4 13	7 25	7 17	10 12	P.M.
Tues.....	6	8 29	7 10	5 55	5 19	8 56	8 21	11 01	1 42
Wed ...	7	9 41	8 08	7 02	6 16	10 16	9 26	11 55	2 51
Thur.....	8	10 39	9 03	7 57	7 05	11 19	10 29	A.M.	3 44
Frid.....	9	11 27	9 57	8 41	7 54	P.M.	11 26	0 50	4 33
Sat.....	10	P.M.	10 48	9 23	8 37	0 59	A.M.	small	large
Sun......	11	0 50	11 39	10 02	9 19	1 41	0 18	2 51	5 35
Mon.....	12	1 29	A.M.	10 40	9 59	2 21	1 04	3 51	6 00
Tues.....	13	2 02	0 29	11 14	10 41	3 00	1 53	4 51	6 26
Wed.....	14	2 38	1 20	11 46	11 22	large	small	5 54	6 54
Thur....	15	large	small	P.M.	A.M.	4 12	3 27	6 53	7 22
Frid.....	16	3 58	3 20	large	small	4 49	4 17	7 52	7 49
Sat.....	17	4 41	4 32	1 41	1 08	5 34	5 14	9 14	8 16
Sun......	18	5 24	5 58	2 40	2 41	6 26	6 20	10 57	8 56
Mon.....	19	6 11	7 35	3 58	5 21	7 20	7 41	P.M.	9 41
Tues.....	20	6 59	8 59	5 02	6 57	8 20	9 06	2 08	10 32
Wed.....	21	7 54	10 01	5 55	7 43	9 18	10 22	large	small
Thur	22	8 41	10 43	6 39	8 12	10 09	11 17	3 39	A.M.
Frid.....	23	9 24	11 17	7 18	8 37	10 55	11 58	4 09	0 13
Sat.....	24	10 05	11 43	7 53	8 57	11 34	P.M.	4 36	1 08
Sun......	25	10 44	P.M.	8 29	9 19	A.M.	1 03	4 50	1 58
Mon.....	26	11 23	0 26	9 02	9 39	0 12	1 33	5 07	2 49
Tues.....	27	A.M.	0 49	9 37	10 02	0 49	2 00	5 27	3 41
Wed.....	28	0 03	1 13	10 14	10 25	1 26	2 28	5 50	4 35
Thur.....	29	0 47	1 43	small	large	small	large	6 12	5 34
Fri.....	30	small	large	11 42	11 33	2 52	3 29	6 36	6 29
Sat.....	31	2 31	2 54	A.M.	P.M.	3 42	4 09	7 16	7 23

Sun's Semi-diameter passing the Meridian, M. 1 S. 5.3.

AUGUST, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of time to be *added* to Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 13	7 18	10 13	8 47 13	9.7	N.17 55 14	38.1	6 4.1	0.15
2	5 14	7 17	10 43	8 51 6	9.7	17 39 51	38.8	6 0.1	0.18
3	5 15	7 16	10 15	8 54 58	9.7	17 24 11	39.5	5 55.4	0.21
4	5 16	7 15	11 49	8 58 49	9.6	17 8 14	40.2	5 50.1	0.23
5	5 17	7 14	A.M.	9 2 40	9.6	16 52 0	40.9	5 44.3	0.26
6	5 18	7 13	0 29	9 6 30	9.6	16 35 30	41.6	5 37.8	0.28
7	5 18	7 12	1 16	9 10 19	9.5	16 18 44	42.2	5 30.6	0.31
8	5 19	7 11	2 13	9 14 8	9.5	16 1 42	42.9	5 22.9	0.33
9	5 20	7 10	3 18	9 17 56	9.5	15 44 25	43.5	5 14 6	0.36
10	5 21	7 09	rises	9 21 44	9.5	15 26 53	44.2	5 5.8	0.38
11	5 22	7 07	8 02	9 25 31	9.4	15 9 6	44.8	4 56 3	0.40
12	5 23	7 06	8 36	9 29 17	9.4	14 51 4	45.4	4 46.3	0.43
13	5 24	7 05	9 08	9 33 3	9.4	14 32 48	46.0	4 35.7	0.45
14	5 25	7 04	9 44	9 36 49	9.4	14 14 18	46.5	4 24.6	0.47
15	5 26	7 03	10 05	9 40 34	9.3	13 55 35	47.1	4 13.0	0.49
16	5 26	7 01	10 35	9 44 18	9.3	13 36 38	47.6	4 0.8	0.51
17	5 27	7 00	11 05	9 48 2	9.3	13 17 29	48.2	3 48.2	0.53
18	5 28	6 58	11 38	9 51 45	9.3	12 58 6	48.7	3 35.1	0.56
19	5 29	6 56	A.M.	9 55 28	9.3	12 38 32	49.2	3 21.5	0.58
20	5 30	6 55	0 13	9 59 11	9.3	12 18 45	49.7	3 7.5	0.59
21	5 31	6 54	0 58	10 2 53	9.2	11 58 46	50.2	2 52.9	0.61
22	5 32	6 53	1 46	10 6 34	9.2	11 38 36	50.7	2 38.0	0.63
23	5 32	6 51	2 37	10 10 15	9.2	11 18 14	51.1	2 22.6	0.65
24	5 33	6 49	3 33	10 13 56	9.2	10 57 42	51.6	2 6.8	0.67
25	5 34	6 48	sets	10 17 36	9.2	10 37 0	52.0	1 50.6	0.68
26	5 35	6 47	7 20	10 21 16	9.2	10 16 7	52.4	1 34.0	0.70
27	5 36	6 45	7 47	10 24 56	9.1	9 55 4	52.8	1 17.0	0.71
28	5 37	6 44	8 17	10 28 35	9.1	9 33 52	53.2	0 59.7	0.73
29	5 38	6 43	8 46	10 32 14	9.1	9 12 31	53.6	0 41.9	0.75
30	5 38	6 41	9 17	10 35 52	9.1	8 51 1	53.9	0 23.9	0.76
31	5 39	6 40	9 49	10 39 30	9.1	8 29 22	54.3	0 5.4	0.77

Monthly Mean of Sun's Semi-diameter, 15′ 50″.6.

SEPTEMBER, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Large.	Small.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	P.M.	A.M.
Sun.	1	3 43	3 43	0 42	1 08	4 39	4 51	7 55	8 40
Mon	2	5 14	4 40	2 13	2 19	5 49	5 42	8 35	11 09
Tues	3	7 05	5 43	4 24	3 42	7 15	6 47	9 26	11 58
Wed	4	8 28	6 49	5 57	5 00	8 47	8 01	10 29	P.M.
Thur	5	9 28	7 56	6 56	6 05	10 04	9 15	small	large
Frid	6	10 14	8 58	7 41	6 58	11 02	10 22	A.M.	3 06
Sat	7	10 55	9 56	8 20	7 45	11 50	11 19	0 59	3 41
Sun.	8	11 33	10 49	8 57	8 29	P.M.	A.M.	2 10	4 09
Mon	9	P.M.	11 39	9 31	9 11	1 11	0 11	3 11	4 35
Tues	10	0 38	A.M.	10 01	9 50	1 50	0 57	4 11	5 00
Wed	11	1 11	0 26	10 30	10 27	large	small	5 07	5 26
Thur	12	large	small	large	small	2 57	2 24	5 52	5 53
Frid	13	2 17	2 01	11 33	11 43	3 35	3 08	6 45	6 25
Sat	14	2 52	3 01	11 59	A.M.	4 10	3 53	7 49	6 55
Sun.	15	3 31	4 19	P.M.	0 37	4 48	4 44	9 03	7 28
Mon	16	4 22	6 01	1 18	2 25	5 32	5 46	10 38	8 01
Tues	17	5 24	7 39	2 46	4 06	6 28	7 02	P.M.	8 38
Wed	18	6 31	8 47	4 17	5 17	7 31	8 29	large	small
Thur	19	7 31	9 31	5 29	6 33	8 40	9 42	2 09	10 54
Frid	20	8 22	10 02	6 24	7 19	9 40	10 36	2 37	A.M.
Sat	21	9 10	10 25	7 02	7 55	10 30	11 17	2 57	0 12
Sun.	22	9 52	10 44	7 40	8 13	11 16	11 51	3 17	1 19
Mon	23	10 33	11 03	8 15	8 31	11 58	P.M.	3 36	2 17
Tues	24	11 13	11 24	8 50	8 52	A.M.	0 55	3 57	3 10
Wed	25	11 52	11 51	9 28	9 26	small	large	4 20	3 55
Thurs	26	A.M.	P.M.	small	large	1 19	1 52	4 48	4 40
Frid	27	small	large	10 45	10 21	2 02	2 22	5 19	5 32
Sat	28	1 35	1 34	11 36	10 57	2 48	2 57	5 49	6 33
Sun.	29	2 38	2 19	A.M.	11 38	3 39	3 34	6 18	7 37
Mon	30	3 54	3 08	0 41	P.M.	4 37	4 20	6 57	8 49

Sun's Semi-diameter passing the Meridian, M. 1. S. 4.

SEPTEMBER, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of time to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	5 40	6 39	10 27	10 43 8	9.1	N. 8 7 36	54.6	0 13.3	0.79
2	5 41	6 37	11 11	10 46 46	9.1	7 45 41	54.9	0 32.4	0.80
3	5 41	6 36	A.M.	10 50 23	9.0	7 23 39	55.2	0 51.7	0.81
4	5 42	6 35	0 02	10 54 0	9.0	7 1 30	55.5	1 11.3	0.82
5	5 43	6 33	1 03	10 57 36	9.0	6 39 15	55.8	1 31.2	0.83
6	5 45	6 32	2 08	11 1 13	9.0	6 16 52	56.1	1 51.3	0.84
7	5 45	6 31	3 19	11 4 49	9.0	5 54 24	56.3	2 11.6	0.85
8	5 46	6 29	4 28	11 8 25	9.0	5 31 50	56.6	2 32.1	0.86
9	5 46	6 27	rises	11 12 1	9.0	5 9 10	56.8	2 52.7	0.86
10	5 47	6 25	7 36	11 15 36	9.0	4 46 25	57.0	3 13.6	0.87
11	5 48	6 24	8 04	11 19 12	9.0	4 23 35	57.2	3 34.5	0.87
12	5 49	6 22	8 33	11 22 47	9.0	4 0 41	57.4	3 55.5	0.88
13	5 50	6 20	9 03	11 26 23	9.0	3 37 42	57.5	4 16.6	0.88
14	5 50	6 19	9 36	11 29 58	9.0	3 14 40	57.7	4 37.8	0.88
15	5 51	6 18	10 11	11 33 33	9.0	2 51 33	57.8	4 59.0	0.88
16	5 52	6 16	10 51	11 37 9	9.0	2 28 23	58.0	5 20.2	0.88
17	5 53	6 14	11 37	11 40 44	9.0	2 5 11	58.1	5 41.4	0.88
18	5 54	6 12	A.M.	11 44 19	9.0	1 41 55	58.2	6 2.6	0.88
19	5 55	6 10	0 28	11 47 55	9.0	1 18 37	58.3	6 23.7	0.88
20	5 56	6 8	1 22	11 51 30	9.0	0 55 17	58.4	6 44.8	0.88
21	5 57	6 7	2 20	11 55 6	9.0	0 31 56	58.4	7 5.7	0.87
22	5 58	6 6	3 22	11 58 41	9.0	N. 0 8 33	58.5	7 26.6	0.87
23	5 59	6 5	4 25	12 2 17	9.0	S. 0 14 51	58.5	7 47.3	0.86
24	6 00	6 3	sets	12 5 53	9.0	0 38 16	58.5	8 7.9	0.86
25	6 00	6 2	6 47	12 9 29	9.0	1 1 41	58.5	8 28.4	0.85
26	6 01	6 0	7 18	12 13 5	9.0	1 25 5	58.5	8 48.6	0.84
27	6 02	5 59	7 50	12 16 42	9.0	1 48 30	58.5	9 8.7	0.83
28	6 03	5 58	8 27	12 20 18	9.0	2 11 53	58.4	9 28.6	0.82
29	6 04	5 57	9 08	12 23 55	9.0	2 35 15	58.3	9 48.2	0.81
30	6 04	5 55	9 57	12 27 32	9.1	2 58 36	58.3	10 7.7	0.80

Monthly Mean of Sun's Semi-diameter, 15′ 57.4″

OCTOBER, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	P.M.	A.M.
Tues	1	5 34	4 07	2 21	1 47	5 46	5 15	7 45	10 10
Wed	2	7 07	5 20	4 29	3 20	7 11	6 26	8 54	11 35
Thur	3	8 11	6 38	5 46	4 45	8 34	7 51	10 26	P.M.
Frid.....	4	9 01	7 51	6 36	5 52	9 42	9 10	A.M.	1 27
Sat.....	5	9 42	8 55	7 15	6 47	10 35	10 15	0 03	2 02
Sun.....	6	10 16	6 51	7 50	7 35	11 21	11 11	1 24	2 33
Mon.....	7	large	small	8 22	8 19	large	small	2 38	3 02
Tues	8	11 17	11 32	large	small	P.M.	A.M.	3 25	3 30
Wed	9	11 47	A.M.	9 27	9 42	1 13	0 45	4 15	4 07
Thur	10	P.M.	0 25	9 53	10 14	1 45	1 28	5 07	4 41
Frid.....	11	0 49	1 18	10 16	10 54	2 17	2 11	6 04	5 05
Sat.....	12	1 23	2 13	10 38	11 40	2 49	2 53	6 59	5 28
Sun.....	13	1 58	3 20	10 58	A.M.	3 19	3 36	7 55	5 49
Mon.....	14	2 37	4 39	11 20	0 44	3 54	4 24	large	small
Tues	15	3 23	6 09	11 51	1 55	4 34	5 22	10 11	6 42
Wed	16	4 23	7 27	P.M.	3 30	5 27	6 29	11 20	7 32
Thur	17	5 39	8 15	3 23	4 50	6 36	7 42	P.M.	8 49
Frid.....	18	small	large	4 51	6 11	7 51	8 48	0 42	10 44
Sat.....	19	7 51	9 05	5 51	6 48	9 01	9 40	1 10	A.M.
Sun.....	20	8 46	9 20	6 37	7 01	small	large	1 36	0 11
Mon.....	21	9 37	9 41	small	large	10 53	11 00	2 01	1 21
Tues	22	10 19	10 04	7 59	7 53	11 41	11 35	2 23	2 23
Wed	23	11 05	10 30	8 35	8 18	A.M.	P.M.	2 57	3 12
Thur	24	11 56	11 04	9 14	8 45	0 28	0 40	3 28	3 57
Frid.....	25	A.M.	11 37	9 59	9 15	1 14	1 13	3 54	4 52
Sat.....	26	0 51	P.M.	10 47	9 43	2 00	1 46	4 20	5 49
Sun.....	27	1 52	0 52	11 44	10 26	2 49	2 25	small	large
Mon.....	28	3 01	1 47	A.M.	11 10	3 41	3 07	5 28	7 50
Tues.....	29	4 19	2 33	1 00	P.M.	4 39	3 57	6 15	8 52
Wed.....	30	5 40	3 42	2 36	1 17	5 47	4 59	7 15	9 57
Thur.....	31	6 47	5 03	4 12	2 50	6 59	6 16	8 46	10 54

Sun's Semi-diameter passing the Meridian, M. 1 S. 5.3.

OCTOBER, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H. M.	H. M.	P. M.	H. M. S	S.	° ′ ″	″	M. S.	S.
1	6 06	5 53	10 55	12 31 9	9.1	S. 3 21 55	58.2	10 26.8	0.79
2	6 06	5 52	11 58	12 34 47	9.1	3 45 11	58.1	10 45.7	0.78
3	6 07	5 50	A.M.	12 38 25	9.1	4 8 25	58.0	11 4.2	0.77
4	6 08	5 48	1 08	12 42 3	9.1	4 31 36	57.9	11 22.5	0.75
5	6 09	5 46	2 15	12 45 42	9.1	4 54 43	57.7	11 40.4	0.74
6	6 10	5 44	3 23	12 49 21	9.1	5 17 46	57 6	11 57.9	0.72
7	6 11	5 43	4 31	12 53 0	9.1	5 40 46	57.4	12 15.1	0.70
8	6 12	5 41	5 37	12 56 40	9.2	6 3 41	57.2	12 31.8	0.69
9	6 13	5 40	rises	13 0 20	9.2	6 26 31	57.0	12 48.1	0.67
10	6 14	5 39	7 00	13 4 1	9.2	6 49 16	56.8	13 3.9	0.65
11	6 15	5 38	7 33	13 7 42	9.2	7 11 55	56.5	13 19.3	0.63
12	6 16	5 37	8 07	13 11 24	9.2	7 34 29	56.3	13 34.1	0.61
13	6 17	5 35	8 44	13 15 6	9.3	7 56 56	56.0	13 48.5	0.58
14	6 18	5 34	9 30	13 18 49	9.3	8 19 17	55.7	14 2.3	0.56
15	6 19	5 32	10 19	13 22 32	9.3	8 41 31	55.4	14 15.5	0.54
16	6 20	5 30	11 11	13 26 16	9.3	9 3 38	55.1	14 28.1	0.51
17	6 21	5 28	A.M.	13 30 0	9.4	9 25 37	54.8	14 40.2	0.49
18	6 22	5 27	0 07	13 33 45	9.4	9 47 28	54.4	14 51.6	0.46
19	6 23	5 26	1 08	13 37 31	9.4	10 9 11	54.1	15 2.4	0.43
20	6 24	5 25	2 08	13 41 18	9.4	10 30 44	53.7	15 12.5	0.41
21	6 25	5 24	3 12	13 45 5	9.5	10 52 9	53.3	15 22.0	0.38
22	6 26	5 23	4 17	13 48 52	9.5	11 13 24	52.9	15 30.8	0.35
23	6 26	5 20	sets	13 52 41	9.5	11 34 29	52.5	15 38.9	0.32
24	6 27	5 19	5 48	13 56 30	9.6	11 55 23	52 0	15 46.2	0.29
25	6 28	5 18	6 24	14 0 20	9.6	12 16 7	51.6	15 52.9	0.26
26	6 29	5 17	7 04	14 4 10	9.6	12 36 39	51.1	16 58.9	0.23
27	6 30	5 16	7 52	14 8 2	9.7	12 56 59	50.6	16 4.1	0.20
28	6 31	5 15	8 47	14 11 54	9.7	13 17 8	50.1	16 8.6	0.17
29	6 32	5 14	9 50	14 15 46	9.7	13 37 3	49.5	16 12.4	0.14
30	6 34	5 13	10 57	14 19 40	9.7	13 56 46	49.0	16 15.4	0.11
31	6 35	5 12	A.M.	14 23 34	9.8	14 16 15	48.4	16 17.6	0.08

Monthly Mean of Sun's Semi-diameter, 16′ 5.6″.

NOVEMBER, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Smal	Small.	Large.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	P.M.	A.M.
Frid. ..	1	7 38	6 29	5 16	4 19	8 11	7 40	10 38	11 40
Sat.	2	8 18	7 47	6 02	5 32	9 11	8 58	A.M.	P.M.
Sun......	3	8 54	8 50	6 39	6 06	10 00	10 04	0 12	0 58
Mon.....	4	9 28	9 51	7 12	7 22	10 43	11 02	1 27	1 29
Tues.....	5	10 00	10 47	7 47	8 09	11 25	11 51	2 38	2 03
Wed	6	10 32	11 41	8 18	8 54	P.M.	A.M.	3 41	2 44
Thur	7	11 04	A.M.	8 46	9 38	0 35	0 38	4 38	3 15
Frid.....	8	11 36	0 35	9 09	10 22	1 05	1 21	5 33	3 41
Sat.....	9	P.M.	1 31	9 32	11 06	1 36	2 02	6 24	4 02
Sun.	10	0 42	2 28	9 55	11 55	2 06	2 43	large	small
Mon.....	11	1 10	3 32	10 17	A.M.	2 36	3 26	8 02	4 42
Tues.....	12	1 44	4 40	10 42	1 03	3 09	4 09	8 49	5 03
Wed.	13	2 26	5 48	11 15	3 14	3 47	4 53	9 32	5 39
Thur.....	14	3 24	6 41	P.M.	4 06	4 38	5 43	10 16	6 46
Frid.....	15	small	large	2 05	4 32	small	large	10 54	8 17
Sat.....	16	6 07	7 28	small	large	7 03	7 34	11 29	10 25
Sun.	17	7 23	7 52	5 12	5 36	8 21	8 26	11 58	A.M.
Mon.....	18	8 23	8 18	6 07	6 01	9 32	9 14	P.M.	0 04
Tues.....	19	9 17	8 45	6 59	6 32	10 30	10 00	0 48	1 16
Wed.....	20	10 14	9 11	7 47	7 06	11 27	10 43	1 30	2 17
Thur.....	21	11 11	9 48	8 34	7 39	A.M.	11 24	2 02	3 16
Frid.....	22	A.M.	10 25	9 19	8 15	0 19	P.M.	2 31	4 13
Sat.....	23	0 09	11 02	10 07	8 51	1 10	0 40	3 02	5 08
Sun......	24	1 10	11 42	10 59	9 28	2 00	1 22	3 33	6 05
Mon.....	25	2 11	P.M.	11 56	10 08	2 50	2 05	small	large
Tues.....	26	3 13	1 17	A.M.	10 53	3 41	2 53	5 01	7 55
Wed.....	27	4 16	2 16	1 03	11 47	4 36	3 46	5 56	8 42
Thur.	28	5 14	3 26	2 18	P.M.	5 32	4 49	7 10	9 26
Fri.....	29	large	small	3 32	2 17	large	small	8 53	10 10
Sat.....	30	6 47	6 16	4 29	3 48	7 25	7 24	10 37	10 49

Sun's Semi-diameter passing the Meridian, M. 1 S. 8.4.

NOVEMBER, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time to be *subtracted* from Apparent Time.	Diff. for One Hour.
	H. M.	H. M	A. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	6 36	5 11	0 05	14 27 29	9.8	S.14 35 30	47.8	16 19.1	0.04
2	6 37	5 09	1 14	14 31 25	9.8	14 54 31	47.2	16 19.7	0.01
3	6 39	5 08	2 21	14 35 22	9.9	15 13 18	46.6	16 19.6	0.02
4	6 40	5 07	3 25	14 39 19	9.9	15 31 49	46.0	16 18.6	0.06
5	6 41	5 06	4 29	14 43 18	9.9	15 50 5	45.3	16 16.9	0.09
6	6 43	5 05	rises	14 47 17	10.0	16 8 5	44.7	16 14.3	0.12
7	6 44	5 04	5 31	14 51 17	10.0	16 25 49	44.0	16 10.9	0.16
8	6 45	5 03	6 04	14 55 18	10.0	16 43 16	43.3	16 6.7	0.19
9	6 46	5 02	6 39	14 59 19	10.1	17 0 26	42.5	16 1.6	0.23
10	6 47	5 01	7 22	15 3 22	10.1	17 17 19	41.8	15 55.7	0.27
11	6 48	5 00	8 10	15 7 25	10.2	17 33 54	41.1	15 48.9	0.30
12	6 49	5 00	9 02	15 11 29	10.2	17 50 11	40.3	15 41.2	0.34
13	6 50	4 59	9 56	15 15 35	10.2	18 6 9	39.5	15 32.7	0.37
14	6 51	4 58	10 52	15 19 41	10.3	18 21 49	38.7	15 23.3	0.41
15	6 52	4 58	11 52	15 23 47	10.3	18 37 9	37.9	15 13.1	0.45
16	6 53	4 57	A.M.	15 27 55	10.3	18 52 9	37.1	15 1.9	0.48
17	6 54	4 57	0 54	15 32 4	10.4	19 6 49	36.2	14 50.0	0.52
18	6 55	4 56	1 56	15 36 13	10.4	19 21 9	35.4	14 37.1	0.55
19	6 56	4 56	3 00	15 40 23	10.4	19 35 9	34.5	14 23.5	0.59
20	6 56	4 55	4 08	15 44 34	10.5	19 48 46	33.6	14 9.0	0.62
21	6 57	4 55	5 18	15 48 46	10.5	20 2 3	32.7	13 53.7	0.67
22	6 58	4 54	sets	15 52 59	10.5	20 14 57	31.8	13 37.6	0.69
23	6 59	4 54	5 40	15 57 13	10.6	20 27 29	30.8	13 20.6	0.72
24	7 00	4 53	6 35	16 1 27	10.6	20 39 38	29.9	13 3.0	0.75
25	7 02	4 53	7 35	16 5 42	10.6	20 51 24	28.9	12 44.5	0.78
26	7 03	4 52	8 45	16 9 58	10.7	21 2 47	27.9	12 25.3	0.81
27	7 04	4 52	9 55	16 14 14	10.7	21 13 45	26.9	12 5.5	0.84
28	7 05	4 51	11 04	16 18 31	10.7	21 24 20	25.9	11 44.9	0.87
29	7 06	4 51	A.M.	16 22 49	10.8	21 34 30	24.9	11 23.6	0.90
30	7 07	4 50	0 14	16 27 8	10.8	21 44 16	23.9	11 1.7	0.93

Monthly Mean of Sun's Semi-diameter, 16′ 13.″3.

DECEMBER, 1889.

Day of Week.	Day of Month.	*San Francisco.* HIGH WATER.		*San Diego.* HIGH WATER.		*Astoria.* HIGH WATER.		*Port Townsend.* HIGH WATER.	
		Large.	Small.	Large.	Small.	Large.	Small.	Small.	Large.
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		A.M.
Sun.	1	7 27	7 31	5 18	5 07	8 17	8 43	A.M.	11 23
Mon	2	8 07	8 44	5 59	6 14	9 07	9 53	0 18	11 55
Tues	3	8 44	9 48	6 36	7 09	10 02	10 52	1 42	P.M.
Wed	4	9 20	10 49	7 10	8 03	10 44	11 45	2 53	1 10
Thur	5	9 51	11 45	7 40	8 53	11 22	A.M.	3 54	1 46
Frid	6	10 24	A.M.	8 10	9 37	11 59	0 33	4 50	2 12
Sat	7	11 00	0 40	8 37	10 25	P.M.	1 17	5 45	2 46
Sun.	8	11 35	1 33	9 04	11 11	1 03	1 57	6 32	3 09
Mon	9	P.M.	2 26	9 30	11 54	1 31	2 37	large	small
Tues	10	0 38	3 19	9 58	A.M.	2 02	3 14	7 50	3 55
Wed	11	1 13	4 08	10 28	0 37	2 37	3 47	8 18	4 22
Thurs	12	1 55	4 48	11 07	1 17	3 16	4 23	8 46	5 15
Frid	13	2 50	5 11	11 59	2 01	small	large	9 22	6 38
Sat	14	small	large	P.M.	2 49	5 08	5 46	9 52	8 18
Sun.	15	5 30	6 15	small	large	6 23	6 31	10 20	10 08
Mon	16	6 49	6 46	4 28	4 27	7 43	7 19	10 46	11 50
Tues	17	7 59	7 20	5 41	5 07	9 01	8 14	11 21	A.M.
Wed	18	9 16	7 52	6 45	5 47	10 10	9 10	11 55	1 16
Thurs	19	10 23	8 31	7 40	6 30	11 14	9 58	P.M.	2 30
Frid	20	11 23	9 16	8 31	7 12	A.M.	10 44	1 13	3 36
Sat	21	A.M.	9 58	9 21	7 53	0 11	11 30	1 48	4 35
Sun.	22	0 20	10 42	10 09	8 14	1 04	P.M.	2 27	5 26
Mon	23	1 15	11 29	10 59	9 15	1 57	1 04	small	large
Tues	24	2 06	P.M.	11 49	9 59	2 44	1 53	4 00	6 55
Wed	25	2 56	1 09	A.M.	10 43	3 32	2 44	4 50	7 33
Thurs	26	3 43	2 08	0 42	11 34	4 18	3 37	6 03	8 06
Frid	27	4 27	3 14	1 36	P.M.	large	small	7 23	8 43
Sat	28	large	small	2 32	1 45	5 50	5 46	8 57	9 17
Sun.	29	5 56	5 53	large	small	6 39	6 59	10 37	9 53
Mon	30	6 42	7 17	4 28	4 42	7 29	8 17	A.M.	10 25
Tues	31	7 25	8 36	5 18	6 01	8 28	9 33	0 18	10 55

Sun's Semi-diameter passing the Meridian, M. 1 S. 10.7.

DECEMBER, 1889.

Day of Month.	*San Francisco.* Sun rises.	Sun sets.	Moon sets.	The Sun's Right Ascension at Greenwich. Apparent Noon.	Diff. for One Hour.	The Sun's Declination at Greenwich. Apparent Noon.	Diff. for One Hour.	Equation of Time to be *subtracted* from / *added* to Apparent Time.	Diff. for One Hour.
	H. M.	H. M	A. M.	H. M. S.	S.	° ′ ″	″	M. S.	S.
1	7 08	4 50	1 19	16 31 27	10.8	S.21 53 36	22.8	10 39.2	0.95
2	7 09	4 50	2 23	16 35 47	10.8	22 2 31	21.8	10 16.0	0.98
3	7 10	4 50	3 25	16 40 7	10.9	22 11 1	20.7	9 52.3	1.00
4	7 11	4 50	4 25	16 44 28	10.9	22 19 5	19.6	9 27.9	1.03
5	7 11	4 50	5 25	16 48 50	10.9	22 26 42	18.5	9 3.1	1.05
6	7 12	4 50	6 26	16 53 12	10.9	22 33 54	17.4	8 37.7	1.07
7	7 13	4 50	rises	16 57 34	10.9	22 40 39	16 3	8 11.8	1.09
8	7 14	4 50	6 04	17 1 57	11.0	22 46 57	15.2	7 45.4	1.11
9	7 14	4 51	6 54	17 6 21	11.0	22 52 48	14.1	7 18.5	1.13
10	7 15	4 51	7 47	17 10 44	11.0	22 58 13	12.9	6 51.3	1.14
11	7 15	4 51	8 43	17 15 9	11.0	23 3 9	11.8	6 23.6	1.16
12	7 16	4 51	9 41	17 19 34	11.0	23 7 39	10.7	5 55.5	1.18
13	7 17	4 52	10 41	17 23 59	11.0	23 11 41	9.5	5 27.1	1.19
14	7 18	4 52	11 41	17 28 24	11.1	23 15 15	8.4	4 58.3	1.20
15	7 19	4 52	A.M.	17 32 50	11.1	23 18 22	7.2	4 29.3	1.21
16	7 19	4 53	0 44	17 37 16	11.1	23 21 0	6.0	4 0.0	1.23
17	7 20	4 53	1 47	17 41 42	11.1	23 23 11	4.8	3 30.5	1.23
18	7 20	4 53	2 53	17 46 8	11.1	23 24 53	3.7	3 0.8	1.24
19	7 21	4 54	4 04	17 50 35	11.1	23 26 8	2.5	2 30.9	1.25
20	7 21	4 54	5 15	17 55 1	11.1	23 26 54	1.3	2 0.9	1.25
21	7 22	4 55	6 30	17 59 28	11.1	23 27 12	0.1	1 30.9	1.25
22	7 22	4 55	sets	18 3 55	11.1	23 27 1	1.0	1 0.8	1.25
23	7 22	4 56	6 22	18 8 21	11.1	23 26 22	2.2	0 30.7	1.25
24	7 23	4 56	7 34	18 12 48	11.1	23 25 15	3.4	0 0.6	1.25
25	7 23	4 57	8 48	18 17 15	11.1	23 23 39	4.6	0 29.3	1.25
26	7 23	4 57	9 59	18 21 41	11.1	23 21 35	5.7	0 59.2	1.24
27	7 24	4 58	11 07	18 26 7	11.1	23 19 3	6.9	1 28.9	1.23
28	7 24	4 58	A.M.	18 30 34	11.1	23 16 3	8.1	1 58.4	1.23
29	7 24	4 59	0 15	18 35 0	11.1	23 12 35	9.3	2 27.7	1.22
30	7 25	5 00	1 17	18 39 25	11.1	23 8 38	10.4	2 56.8	1.20
31	7 25	5 01	2 18	18 43 51	11.0	23 4 14	11.6	3 25.5	1.19

Monthly Mean of Sun's Semi-diameter, 16′ 17.5″.

To Find the Time of the Two Low Waters

At San Francisco, San Diego, Port Townsend and Intermediate Points.

Turn to the Almanac for the required locality and day, and if the headings over the High Waters at the preceding change of tide are in the order *Large—Small*, the Moon's declination is North, and Table A is to be used. Count the number of days from the headings downwards, until the required day is reached ; then add the time of High Water in the first column of the Almanac to the hours and minutes indicated for the same day in Table A, and the product will be the Low Water *large* next succeeding. To the time of High Water *Small* of the same day, in the second column of the Almanac, add the hours and minutes given in Table B, and the product will be low water *small*. If the headings over the High Waters are in the order *Small—Large*, the Moon's declination is South, and the tables are to be transposed, by adding the quantities in Table B to the time of High Water in the first column of the Almanac, and the quantities in Table A to the second column.

Attention must be paid to the A. M. and P. M. headings, as the product will sometimes run into the morning of the following day. Should the locality be other than one of the four principal ports, turn to the Table of Tidal Constants and apply the proper correction. Where the change of tide occurs, the tides are omitted for those days to make room for the heading ; in such cases they can be estimated very closely by proportion. The term *Large* indicates an *extreme* tide, either of High or Low Water ; the term *Small* indicates a *medium* tide.

San Francisco.			San Diego.			Astoria.			Port Townsend.		
Days.	A	B	Days.	A	B	Days.	A	B	Days.	A	B
	H. M.	H. M.		H. M.	H. M.		H. M.	H. M.		H. M.	H. M.
1	5 45	6 00	1	5 55	6 25	1	6 25	6 30	1	3 50	7 55
2	6 05	5 40	2	6 15	5 55	2	6 45	6 15	2	4 20	7 50
3	6 20	5 20	3	6 50	5 20	3	7 00	6 00	3	4 45	7 40
4	6 30	5 00	4	7 15	4 45	4	7 10	5 45	4	5 05	7 15
5	6 45	4 45	5	7 30	4 15	5	7 20	5 30	5	5 25	6 45
6	7 00	4 30	6	7 40	3 55	6	7 25	5 20	6	5 40	6 15
7	7 05	4 25	7	7 40	3 50	7	7 30	5 16	7	5 55	5 40
8	7 08	4 25	8	7 35	4 00	8	7 35	5 15	8	6 15	5 10
9	7 08	4 30	9	7 32	4 10	9	7 35	5 16	9	6 35	4 40
10	7 00	4 35	10	7 30	4 20	10	7 30	5 20	10	6 50	4 10
11	6 50	4 45	11	7 15	4 25	11	7 20	5 30	11	7 10	3 45
12	6 40	5 00	12	7 05	4 40	12	7 10	5 40	12	7 25	3 30
13	6 35	5 10	13	6 55	5 05	13	7 00	5 50	13	7 30	3 25

Tidal Constants.

San Francisco Tide Table—(North Beach).

To obtain the time of High Water at the following points, find the time for San Francisco; then for

		H.	M.
Fort Point	Subtract	0	13
Oakland	Subtract	0	04
Monterey	Subtract	1	43
Santa Cruz	Subtract	1	40
Half-Moon Bay	Subtract	1	41
South Farallon	Subtract	1	27
Saucelito	Subtract	0	35
Tomales Bay	Subtract	0	08
Bodega Bay	Subtract	1	02
Drake's Bay	Subtract	0	25
Point Reyes	Subtract	1	31
Navarro River	Subtract	1	20
Little River Harbor	Subtract	2	02
Big River Bridge	Subtract	1	23
Westport	Subtract	0	53
Point Wilson (San Francisco Bay)	Add	1	16
Mare Island (San Francisco Bay)	Add	1	33
Benicia (San Francisco Bay)	Add	1	54
Army Point (San Francisco Bay)	Add	2	00
Collinsville (San Francisco Bay)	Add	2	51
Guano Island (San Francisco Bay)	Add	0	08
Ravenswood (San Francisco Bay)	Add	0	30
Sacramento City	Add	7	38

NOTE.—The time of High Water on "San Francisco Bar" is about sixty-one minutes earlier than the computed time for San Francisco (North Beach); and at the "Heads" about forty minutes earlier. At the "Heads" the *current* changes from half an hour to one and a half hours after the change of tide; but during great freshets in the Bay, the mid-channel surface-current sometimes runs ebb during the whole of the flood tide.

San Diego Tide Table—(Near La Playa).

To obtain the time of High Water at the following points, find the time for San Diego; then for

		H.	M.
Cape St. Lucas	Subtract	1	53
Margarita Island (Magdalena Bay)	Subtract	1	07
Man-of-War Cove (Magdalena Bay)	Subtract	1	05
Cuyler's Harbor (San Miguel Island)	Subtract	0	10
Prisoner's Harbor (Santa Cruz Island)	Subtract	0	04
Santa Monica	Add	0	01
Anaheim Landing	Add	0	14
Santa Barbara	Add	0	24
Gaviota	Add	0	16
San Pedro	Add	0	12
Point Sal	Add	0	22
San Luis Obispo	Add	0	44
Hueneme	Add	0	10
Newport Landing	Add	0	38

Astoria Tide Table.

To obtain the time of High Water at the following points, find the time for Astoria; then for

		H.	M.
Humboldt Bay (Red Bluff)	Subtract	1	20
Humboldt Bay (Eureka)	Subtract	1	04
Crescent City	Subtract	1	14
Chetco River	Subtract	1	07
Trinidad Harbor	Subtract	1	23
Port Orford	Subtract	1	10
Coquille River	Subtract	1	16
Koos Bay (Pigeon Point)	Subtract	0	55
Koos Bay (North Bend)	Add	0	17
Yaquina Bay	Subtract	0	50

Astoria Tide Table.- Continued.

		H.	M.
Oysterville (Yaquina River)	Subtract	0	25
Tillamook Bay	Subtract	0	31
Clatsop (near Point Adams)	Subtract	0	30
Cape Disappointment	Subtract	0	32
Shoalwater Bay	Subtract	0	09
Destruction Island	Subtract	0	42
Neeah Harbor	Subtract	0	10
Fort Stevens (Columbia River)	Subtract	0	20
Skippennon Creek (Columbia River)	Subtract	0	14
Tongue Point (Columbia River)	Add	0	11
Marsh Island Creek (Columbia River)	Add	0	47
Cathlamet (Columbia River)	Add	1	17
Eagle Cliff (Columbia River)	Add	1	56
Rainier (Columbia River)	Add	2	48
St. Helens (Columbia River	Add	4	07
Ahosette (Vancouver Island)	Subtract	0	35
Gray's Harbor	Subtract	0	25
Sitka	Subtract	0	02
Kadiak Island	Subtract	0	07

NOTE.—At the mouth of Columbia River the *current* changes from one-half hour to one hour after the change of tide; but during great freshets the ebb current lasts much longer than the ebb tide.

Port Townsend, W T., Tide Table.

To obtain the time of High Water at the following points, find the time for Port Townsend; then for

		H.	M.
New Dungeness	Subtract	1	14
Washington Harbor	Subtract	0	48
Port Discovery	Subtract	0	47
Port Gamble	Add	0	05
Restoration Point	Add	0	20
Port Madison	Add	0	18
Muckilteo	Add	0	56
Port Blakeley	Add	0	15
Seattle	Add	0	26
Shilshole Bay	Add	0	18
Steilacoom	Add	0	51
Semi-ah-moo Bay	Add	0	53
Tacoma	Add	0	28
Dofflemeyer's Point (Budd's Inlet)	Add	1	00

Light-Houses on the Western Coast.

[CORRECTED TO OCTOBER, 1888.]

Description of the buildings, that they may be recognized in the day-time.

POINT LOMA—A low, brick tower (gray), rising from keeper's dwelling (yellow); lantern, red; on the highest part of the point, and about half a mile from its extremity.

POINT FERMIN—Square, wooden tower (white), rising from keeper's dwelling (white); dome of lantern, black.

POINT HUENEME—Square, wooden tower (white), rising from keeper's dwelling (white); dome of lantern, black.

SANTA BARBARA—A low tower (gray), rising from keeper's dwelling (white); green shutters to windows; lantern, red.

POINT CONCEPTION—A low brown tower rising from keeper's dwelling (brown); lantern, red.

PIEDRAS BLANCAS—A white, conical tower, 90 feet high, balustrade and gallery black; dome of lantern, black.

POINT SUR—A first-class Light and Fog Signal will be in operation before the close of the year 1888.

POINT PINOS—A low, round, brick tower (white), rising from keeper's dwelling (dark gray); lantern, black.

SANTA CRUZ—A small, square tower (white), rising from keeper's dwelling (white, with green blinds) ; dome of lantern red.

PIGEON POINT—A conical brick tower (white) ; lantern black, with black dome ; keeper's dwelling, two stories, of wood, painted light buff, with red roof, and standing northwestward of tower.

SOUTH FARALLON—White conical tower, lantern red.

POINT BONITA—A low, white tower, brick, rising from the center of a one-story building ; lantern red.

ELECTRIC LIGHTS—*Caution to Navigators*—An electric light is placed on a mast, on Telegraph hill, and another, also on a mast, near the foot of Stanyan Street, the former visible to vessels in the vicinity of the North Head only, the latter to vessels at all points seaward ; it is proposed to screen this light from being visible seaward.

POINT REYES—A white, sixteen-sided tower, lantern red, dwelling white, and built 215 feet higher up the slope.

POINT ARENA—A white, conical tower ; dome of lantern black ; (gallery, balustrade, and band black); keeper's dwelling (white) 60 feet in the rear.

CAPE MENDOCINO—A white tower of 16 sides ; lantern white, dome and balustrade red ; keeper's dwelling white, standing 150 feet to the east-south-east of tower.

HUMBOLDT—White conical tower, rising from keeper's dwelling (white) ; dome of lantern and balustrade red.

TRINIDAD HEAD—A white pyramidal tower, lantern, dome and railing red ; keeper's dwelling white, standing 50 yards to the north-east.

CRESCENT CITY—A low white tower, rising from keeper's dwelling (buff); dome and balustrade red.

CAPE BLANCO—A white conical tower, keeper's dwelling also white, standing 100 feet to the south ; lantern black.

CAPE ARAGO (GREGORY)—A brown octagonal iron tower ; brown dome and lantern black ; white dwelling, 350 yards to the southeast.

CAPE FOULWEATHER (YAQUINA HEAD)—A conical white tower ; lantern, parapet and dome painted black ; white dwelling, 70 feet east.

TILLAMOOK ROCK—A square white tower, rising from the center of a white dwelling ; lantern and dome black.

POINT ADAMS—A low square tower of wood, white, rising from dwelling (light buff) ; lantern black, dome black.

CAPE DISAPPOINTMENT—A conical white tower, rising from keeper's dwelling (white) ; lantern black.

SHOALWATER BAY—A white conical tower, rising from keeper's dwelling (both of brick) ; lantern black.

CAPE FLATTERY—A conical white tower, rising from keeper's dwelling (gray stone); lantern black.

EDIZ HOOK— A square white tower on keeper's dwelling, dome of lantern black.

NEW DUNGENESS—A conical tower rising from dwelling (yellow sandstone), upper part of tower black, lower part white, lantern black.

SMITH'S ISLAND—A low conical white tower, rising from white dwelling ; lantern black.

ADMIRALTY HEAD—A low square white tower, rising from the south end of a white dwelling, lantern black.

POINT WILSON—A square white tower, rising from keeper's dwelling (white) ; lantern and dome black.

POINT-NO-POINT—A low, square, white tower, white dwelling, 200 feet to westward ; lantern and dome black.

WEST POINT (SANDY POINT)—A low square white tower, dome and parapet of lantern black.

RACE ROCKS—A stone tower, painted with five alternate horizontal black and white bands ; keeper's dwelling of stone.

LIGHT-HOUSES ON THE WESTERN COAST OF THE UNITED STATES.

NAME OF STATION.		LOCALITY.	Lat. N.		Lon. W.		Var.	
			°	′	°	′		
Point Loma Light-House, 3, F W	24	W side entrance to San Diego Bay, 462 feet high	32	40 13	117	14 38	..E..	
Point Fermin Light-House, 4 Fl R & W 10 secs	19	W side entrance San Pedro Bay	33	42 14	118	17 41	.....	
Point Hueneme L H., 4, F W, 1 m, 6 Fls, next M	13	On mainland, east. ent. to Santa Barbara Channel	34	08 38	119	12 40	14	17
Santa Barbara Light-House, 4 F W	17	On the point, two miles SW of landing, 180 feet	34	23 45	119	43 22	.....	
Point Conception Light-House 1 Fl W½ M	18	Point Conception, 135 feet high	34	26 53	120	28 16	.....	
Piedras Blancas Light House, 1 F W V W F 15 secs	19	On the point, NW of entrance to San Simeon Bay	35	39 45	121	16 56	15	30
Point Pinos Light-House, 3 F W	15	On the point, S side entrance to Monterey Bay	36	37 54	121	56 00	.....	
Santa Cruz Light-House, 5 F R	18	On Point Santa Cruz	36	57 00	122	01 32	.....	
Pigeon Point Light-House, 1 Flg W 10 secs	18	On extremity of Pigeon Point	37	10 48	122	23 35	.....	
South Farallon L. H., 1 Flg W, every M	26	23½ miles SW by W¼ W off ent. to S. F. Bay 360 feet	37	41 49	123	00 04	.....	
Point Bonita Light-House, 2 F W	17	North head of entrance to San Francisco Bay	37	48 48	122	31 44	.....	
Fort Point L. H., 4 F W 1 Min 4 R Fls. next M	15	South side of entrance to San Francisco Bay, 83 feet	37	48 31	122	28 38	.....	
Alcatraz Island Light-House, 3 F W	19	In the harbor of San Francisco, 166 feet	37	49 27	122	25 19	.....	
Point Reyes L. H., 1 Fl W every 5 secs	23	On Western Part of Head, 296 feet	37	59 39	123	01 20	.....	
Point Arena Light-House, 1 F W	19	Near N W extremity of the Point, 156 feet	38	57 10	123	44 47	17	24
Cape Mendocino L. H., 1 Flg W every 30 secs	28	West slope of Cape, 423 feet	40	26 21	124	24 14	.....	
Humboldt Light-House, 4 F W	14	On the north point, one mile from inlet, 53 feet	40	46 04	124	13 06	.....	
Trinidad Head L. H., 4 F W V R F every M	17	On Trinidad Head	41	03 04	124	08 56	.....	
Crescent City L. H., 4 F W V W Fl every 90 secs	14	On the extreme W part of the point, 80 feet	41	44 34	124	12 22	18	54
Cape Blanco Light-House, 1 F W	23	On the highest part of the Cape	42	50 07	124	33 00	.....	
Cape Gregory L. H., 4 F W V W F every 2 M	14	On small island at west extremity of Cape, 75 feet	43	20 38	124	22 20	.....	
Cape Foulweather Light-House, 1 F W	19	Westerly end of the Cape, 160 feet high	44	41 30	124	05 00	.....	
Tillamook Rock Light-House, 1 Flg W every 5 secs.	18	18 miles south of entrance to Columbia River	45	56 11	124	01 12	21	05
Point Adams Light-House, 4 F R	16	On low ridge, entrance to Columbia River	46	11 32	123	58 40	.....	
Cape Disappointment Light-House, 1 F W	22	Near the highest part of the Cape	46	16 33	124	03 13	.....	
Shoalwater Bay L. H., 4 F W V W F every 2 M	15	North point of entrance to Shoalwater Bay, 87 feet	46	43 00	124	04 24	.....	
Tatoosh Island L. H. 1 F W with R danger ray	19	Off Cape Flattery, Strait of Juan de Fuca	48	23 23	124	44 30	.....	
Cape Beale L H., 1 W visible 30 secs., eclipsed 30 s.	19	S E point of entrance to Barclay Sound, 164 feet	48	47 30	125	12 48	22	02
Saturnia Island L. H., Rev. long Fl., every 30 secs.	18	Ex. of E point, N W side of N ent. to Canal de Haro	48	47 00	123	03 02	.....	
Discovery Isld. Light House, 5, F W	15	Easterly extremity of Discovery Isld., Fuca Strait	48	25 20	123	13 50	.....	
Ediz Hook Light-House, 5 F W	12	On extremity of Spit	48	08 25	123	24 07	.....	
New Dungeness Light-House, 3 F W	16	On the end of the Sand Spit, Strait of Juan de Fuca	48	10 59	123	06 31	.....	
Smith's Island Light-House, 4 Fl W every ½ M	15	S W point of the Island	48	19 07	122	50 36	.....	
Admiralty Head Light-House, 4 F W	16	E side of entrance to Admiralty Inlet, 108 feet	48	09 17	122	40 34	.....	
Point-no-Point Light-House, 5 F W	10	16 miles S E from Admiralty Head	47	54 41	122	31 06	.....	
Point Wilson Light-House, 4 F W	13	On spit 3 miles N W of Port Townsend	48	08 41	122	45 05	.....	
West Point, Sandy Point, 4 Fl R & W every 10 secs—		5 miles N W of Seattle	47	39 45	122	25 50	.....	
Race Rocks, Light-House, 2 W Fl every 10 secs	18	Southernmost point Vancouver, S. J. de Fuca, 118 ft.	48	17 59	123	32 12	.....	
Fisgard Island Light-House, 4 F W & F R	14	Keep the *white* light in view, for safety	48	25 36	123	27 12	22	10
Victoria Harbor Light-House, 5 F Blue	10	On Berens Island, W side entrance	48	25 18	123	24 00	.....	

NOTE.—The numerals first given after each Light-House indicate the order of the lights; F W signifies fixed white; F R, fixed red; Flg W, flashing white; Flg R, flashing red; Flg R & W, flashing red and white; F W V W F, fixed white varied by white flashes; F W V R F, fixed white, varied by red flashes; F W V R & W F, fixed white varied by red and white flashes; F R V R F, fixed red varied by red flashes. The time between the flashes is denoted by M (minutes) and sec (seconds), and the concluding numerals denote the distance at which the light may be seen, under ordinary states of the atmosphere, from a height of 20 feet above the sea.

Fog Signals on the Coasts of California, Oregon, and Washington Territory.

[Corrected to October, 1888.]

POINT CONCEPTION—A steam whistle with blasts of 8 seconds at intervals of 52 seconds.

POINT AÑO NUEVO—A steam whistle giving blasts of 10 seconds, followed by intervals of 55 seconds.

PIGEON POINT—A steam whistle giving blasts of 4 seconds' dura tion, with alternate intervals of 7 and 45 seconds.

POINT MONTARA—A steam whistle giving blasts of 5 seconds, with an interval of 25 seconds.

SOUTH FARALLON—A first-class steam siren, giving blasts of 5 seconds' duration, at intervals of 45 seconds.

SAN FRANCISCO BAR, OUTSIDE—Whistling Buoy (see list of Buoys).

POINT BONITA—A first-class steam siren, gives blasts of 4 seconds, at intervals of 35 seconds.

FORT POINT—A bell struck by machinery every 10 seconds.

LIME POINT—A 12-inch steam whistle, giving blasts of 10 seconds, with intervals of 30 seconds.

ANGEL ISLAND—A bell struck by machinery, a double blow every 15 seconds.

ALCATRAZ ISLAND—A bell struck by machinery, 5 blows at intervals of 10 seconds, followed by a pause of 25 seconds.

YERBA BUENA ISLAND, SAN FRANCISCO BAY—A steam whistle giving blasts of 4 seconds, with intervals of 16 seconds. If the whistle be disabled, a bell will be sounded at intervals of 10 seconds

EAST BROTHER ISLAND, SAN FRANCISCO BAY—Steam whistle, blasts of 8 and 4 seconds, with intervals of 24 seconds. If the whistle be disabled, a bell is struck by hand every 15 seconds.

MARE ISLAND, SAN FRANCISCO BAY—A bell struck by machinery at intervals of every 10 seconds.

POINT REYES—A first-class steam siren is placed at this point, giving blasts of 5 seconds, at intervals of 70 seconds.

POINT ARENA—A steam whistle, giving blasts of 5 seconds, with intervals of 25 seconds.

HUMBOLDT BAY—On the north side of the entrance, and three-fourths of a mile from the inlet, a first-class steam whistle, giving alternate blasts of 4 and 8 seconds, with intervals of 24 seconds.

TILLAMOOK ROCK—A steam siren, giving blasts of 5 seconds, at intervals of 1½ minutes.

TATOOSH ISLAND (Cape Flattery)—A steam whistle is placed at the lighthouse, giving blasts of 8 seconds, at intervals of 52 seconds.

NEW DUNGENESS—A steam whistle, giving blasts of 6 and 3 seconds, at alternate intervals of 12 and 39 seconds.

POINT WILSON—South side of Admiralty Inlet, near Port Townsend. A steam whistle giving blasts of 8 seconds, at intervals of 52 seconds.

POINT-NO-POINT. A bell struck by machinery, giving a single blow at intervals of 10 seconds.

WEST POINT, SANDY POINT—Daboll trumpet, giving blasts of 5 seconds, interval 25 seconds.

POINT ROBINSON—A steam whistle giving blasts of 6 seconds every 54 seconds.

RACE ROCKS—A steam whistle, giving blasts of 5 seconds, at intervals of 72 seconds.

EDIZ HOOK—A bell struck by machinery, giving a single blow at intervals of 15 seconds.

COAST DIRECTORY.

DISTANCES FROM SAN FRANCISCO BY STEAMER ROUTE.

UP THE COAST.

	Miles.
To Duxbury Point	17
Point Reyes	34
Point Tomales	49
Bodega Head	52
Rules Landing	61
Russian River	62
Fort Ross	66
Timber Cove	70
Stillwater Cove	71
Salt Point	73
Fisk's Mill	76
Stewart's Point	79
Bihler's Point (Black Pt.)	81
Bowen's anLding	88
Collins' Landing	89
Fish Rock	91
Phelps' Landing	93
Signal Port	94
Rough and Ready	96
Saunders' Landing	97
Point Arena	100
New Haven	107
Bridgeport	108
Cuffey's Cove	111
Navarro River	114
Whitesboro (Salmon Cr'k)	116
Albion River	117
Little River	120
Mendocino City (Big R'vr)	123
Caspar	128
Noyo River	129
Fort Bragg Landing	130
Laguna Port	133
Newport, North	144
Westport	148
Rockport	151
Shelter Cove	165
Point Gorda	183
To Cape Mendocino	194
Humboldt Bay	215
Trinidad Head	233
Pt. St. George (Crescent City)	275
Rogue River	318
Port Orford	330
Cape Orford	337
Coquille River	355
Cape Gregory (Empire City)	369
Umpqua River	390
Cape Perpetua	429
Alseya River	437
Yaquina Bay	450
Cape Foulweather	459
Oyster Bay	495
Tillamook Bay	502
Tillamook Head	525
Point Adams	541
Cape Disappointment	546
Toke Point (Shoalwater Bay)	571
Gray's Harbor	584
Point Grenville	607
Cape Flattery	675
Port Angeles	740
Port Townsend	765
Seattle	803
Tacoma	824
Steilacoom	833
Olympia	856
Victoria	744
New Westminster	815
Nanaimo	822
Barclay Sound	706
Nootka Sound	774
Sitka	1333

COAST DIRECTORY.

DISTANCES FROM SAN FRANCISCO BY STEAMER ROUTE.

DOWN THE COAST.

	Miles.		Miles.
To Point Lobos	7½	To Point Purissima	214
Point San Pedro	20	Point Arguello	224
Point Montara	23	Point Conception	237
Pillar Point	26	Gaviota	250
Amesport Landing	29	Santa Barbara	274
Point Miramontes	31	Carpenteria	284
Gordon's Chute	32	San Buenaventura	296
Pescadero Point	42	Hueneme	301
Pigeon Point	46	Point Duma	324
Point New Year	51	Santa Monica	340
Davenport Landing	59	Point Vincent	347
Williams' Landing	61	Wilmington	356
Point Santa Cruz	71	Anaheim Landing	365
Aptos Wharf	76	Newport Landing	373
Pajaro Landing	81	Point Loma	430
Gibson's Landing	83	San Diego	437
Salinas Landing	84	Port San Quentin	562
Point Pinos	86	Cerros Island	730
Point Sur	102	Magdalena Bay	1000
Cape San Martin	136	Cape St. Lucas	1143
Piedras Blancas	154	Mazatlan	1343
San Simeon	158	Guaymas	1503
Leffingwells	163	Cape Corrientes	1413
Cayucos	175	Manzanillo	1513
Moro Rock	180	Acapulco	1810
Point Buchon	183	Realejo	2585
Port Harford	188	Nicaragua	2684
Point San Luis	194	Coiba Island	3018
Point Sal	207	Panama	3240

Phases of the Moon, 1889.

Pacific Standard Time.

JANUARY.

	D	H	M	
New Moon	1	1	8	even
First Quarter	8	4	41	even
Full Moon	16	9	37	even
Last Quarter	24	7	57	morn
New Moon	31	1	10	morn
Apogee	12	9		morn
Perigee	28	11		morn

FEBRUARY.

First Quarter	7	0	58	even
Full Moon	15	2	17	even
Last Quarter	22	3	55	even
Apogee	9	5		morn
Perigee	24	6		morn

MARCH.

New Moon	1	2	1	even
First Quarter	9	9	59	morn
Full Moon	17	3	47	morn
Last Quarter	23	10	54	even
New Moon	31	3	37	morn
Apogee	9	1		morn
Perigee	21	5		morn

APRIL.

First Quarter	8	5	47	morn
Full Moon	15	2	19	even
Last Quarter	22	5	56	morn
New Moon	29	6	5	even
Apogee	5	8		even
Perigee	17	5		even

MAY.

First Quarter	7	10	42	even
Full Moon	14	10	42	even
Last Quarter	21	1	53	even
New Moon	29	9	20	morn
Apogee	3	1		even
Perigee	15	11		even
Apogee	30	9		even

JUNE.

First Quarter	6	0	1	even
Full Moon	13	5	58	morn
Last Quarter	19	11	35	even
New Moon	28	0	54	morn
Perigee	13	8		morn
Apogee	27	1		morn

JULY.

	D	H	M	
First Quarter	5	9	58	even
Full Moon	12	1	2	even
Last Quarter	19	11	45	morn
New Moon	27	4	1	even
Perigee	11	5		even
Apogee	24	8		morn

AUGUST.

First Quarter	4	5	27	morn
Full Moon	10	8	43	even
Last Quarter	18	2	52	morn
New Moon	26	6	0	morn
Perigee	8	11		even
Apogee	20	10		even

SEPTEMBER.

First Quarter	2	11	35	morn
Full Moon	9	5	53	morn
Last Quarter	16	8	48	even
New Moon	24	6	42	even
Perigee	5	5		even
Apogee	17	5		even

OCTOBER.

First Quarter	1	5	33	even
Full Moon	8	5	26	even
Last Quarter	16	4	37	even
New Moon	24	6	26	morn
First Quarter	31	0	30	morn
Perigee	1	8		morn
Apogee	15	1		even
Perigee	27	9		morn

NOVEMBER.

Full Moon	7	8	5	morn
Last Quarter	15	0	36	even
New Moon	22	5	44	even
First Quarter	29	9	29	morn
Apogee	12	8		morn
Perigee	24	7		morn

DECEMBER.

Full Moon	7	1	52	morn
Last Quarter	15	6	58	morn
New Moon	22	4	53	morn
First Quarter	28	9	16	even
Apogee	9	12		even
Perigee	22	5		even

RULES AND REGULATIONS

OF THE

PORT OF SAN FRANCISCO,

ADOPTED BY THE

Board of State Harbor Commissioners,

February 1st, 1887.

1. Vessels must not be anchored, nor moored, between a line drawn from the outer end of Jackson Street Wharf to the most southerly point of Goat Island, and a line drawn from the outer end of Mission Street Wharf to the Ferry Slip of the South Pacific Coast Railroad Company, on the Alameda side of the Bay; nor must they be anchored so as to permit them to swing between said lines.

2. Vessels must not be anchored, nor moored, between a line drawn from the intersection of the north line of Townsend Street with the easterly line of the Pacific Mail Steamship Company's Wharf, to the extreme westerly end of the north training wall of Oakland Harbor, and a line drawn from the outer end of Berry Street Pier to the extreme westerly end of the south training wall of Oakland Harbor; nor must they be anchored so as to permit them to swing between the said lines, nor within 800 feet of the Hay Wharf.

3. Vessels must not be anchored, nor moored, between a line drawn from the southeasterly end of the Grain Sheds on the Sea Wall to the highest point of Angel Island, visible from the said southeasterly end of the Grain Sheds, and a line drawn from the northwesterly end of the said Grain Sheds to the light on Alcatraz Island; nor must they be anchored so as to permit them to swing between the said lines.

4. Vessels must not be anchored, nor moored, within five hundred yards of a line drawn from the extreme northerly end of the Sea Wall, southerly through the extreme outer ends of the piers to the intersection of the easterly line of Third Street with the northerly line of Channel Street.

5. Vessels propelled by steam, except when going to or leaving the Sea Wall, must not run inside of a line six hundred feet distant from, and parallel with, the said Sea Wall.

6. A vessel will not be entitled to a berth, until an application shall have been made to the Chief or Assistant Chief Wharfinger; and such application must state the draught of the vessel, kind of cargo, and locality desired. No application shall be entertained unless the vessel be in the harbor, and ready to be docked. Berths shall be assigned in the order of the applications; provided, that vessels ready to discharge cargo shall have preference over those ready to receive cargo. No one except the Chief or Assistant Chief Wharfinger has authority to assign berths to vessels. When a vacant berth is assigned to a vessel, said assignment will hold good for twenty-four hours, but for a berth not vacant said assignment will hold good for twenty-four hours after it becomes vacant.

7. Vessels must haul or go into the stream at their own expense when ordered to do so by the Chief or Assistant Chief Wharfinger. Upon failure to obey such order, the Chief or Assistant Chief Wharfinger shall have power to cause such removal at the expense of such vessel or vessels.

8. Vessels, when being moved into a slip, or alongside the wharf, must approach "head on," and when at a wharf, must lie head toward the shore. The studding-sail booms and sprit-sail yards must be rigged in; their offshore anchors suspended ready for dropping; their lower and top-sail yards braced "sharp up" on their in-shore braces, except when in actual use, discharging or loadiug cargo; and when required by the Wharfinger, their movable fore-and-aft spars and martingale must be rigged in.

9. A vessel anchored or moored in the harbor, or lying in a slip or dock, must at all times have on board at least one seaman capable of taking proper care of such vessel. If it becomes necessary, a vessel may be removed by the order of the Chief Wharfinger at the expense of the owner, and the owner and the vessel shall be liable for all damage that shall arise thereby.

10. When ballast, stone, coal, brick, ashes, cinders, dust, rubbish, or other loose matter or thing that will sink is being landed from a vessel upon a wharf, or is being transfered from one vessel into another, a canvas chute or other contrivance, to the satisfaction of the Wharfinger, must be used to prevent any part of such substance from falling into the dock.

11. Fire must not be used on board of any vessel at the wharves or in the slips, for heating pitch, tar, or other inflammable substances, but may be used on floating stages or boats, for the purpose of heating such substances for repairing vessels; *provided*, such fire is constantly in the charge of a person capable of taking proper care of the same.

12. Every steam engine, when used upon any wharf for loading or

unloading cargo, must have upon its smoke-stack a bonnet or spark-catcher that will effectually prevent sparks from falling upon such wharf, or upon the deck of any vessel.

13. Not more than one hundred piles or pieces of timber shall be discharged or allowed to remain in any slip or dock at any time; nor shall any piles or timber be left in any dock or slip over night, without the permission of the Wharfinger.

14. No substance that will sink, or form an obstruction to navigation, shall be deposited in the water or on the shore of the harbor, without first obtaining permission in writing from the Harbor Commissioners.

15. Rubbish, or other substance on which no wharfage is charged, shall be removed from the wharf by the person placing it there; and, on defanlt, it must be removed by the Wharfinger at such person's expense. Coal screens, donkey engines, and all stevedores' tools and appliances must be removed from the wharf when directed by the Wharfinger.

16. Neither the slips, docks, basins nor wharves, nor the spaces in front of them, nor the streets along the water front, shall be obstructed by any material or structure. If any snch obstruction be not removed within twenty-four hours after notice, the material or structure constituting the obstruction shall be removed and stored, or sold by the Commissioners; and twenty-five dollars will be charged for each day that the obstruction is permitted to remain, together with the expense of removal, storage or sale.

17. No person shall have authority to collect dockage, wharfage, tolls, or rents, unless authorized by the Board of State Harbor Commissioners, except on wharves held under lease pursuant to acts of the Legislature. Lessees of wharves, authorized to collect dockage, wharfage, or tolls, must charge and collect the same rates as those fixed by the Board for the wharves not under lease.

18. If any vessel leave a wharf, slip, dock or basin, unless forced to do so by stress of weather, without first paying the dockage due, such vessel will be placed upon the delinquent list, and must not be permitted to use any wharf, slip, dock or basin without first paying double the bill incurred and ten dollars in addition thereto, except by permission of the Commisioners.

19. The master, agent or owner of a vessel refusing or neglecting to obey the orders of the Chief or Assistant Chief Wharfinger, in any matter pertaining to the regulation of the Harbor, or removal or stationing of such vessel, is guilty of a misdemeanor, and liable to a fine not exceeding three hundred dollars, or imprisonment not exceeding one hundred days.

20. In case any damage is done to a wharf, shed or other structure on the water front by a vessel, or otherwise, the said damage, together with the name of the vessel or person causing it, must be reported forth-

with by the Wharfinger to the Chief Engineer, and the expense of the repairs of said damage will be charged to such vessel or individual.

21. Dockage commences upon a vessel when she makes fast to a wharf, or comes within a dock, slip, basin or canal; and each twenty-four hours thereafter, or part thereof, constitutes a day's dockage.

22. No deductions will be made for Sundays, holidays, or rainy days.

23. A vessel arriving from leased premises will be charged at the same rate and in the same manner as if arriving from the stream.

24. If a vessel occupies two different berths on the same day, she will be charged dockage for but one day, which must be paid at the wharf first occupied.

25. Vessels may be assigned berths to repair at quarter dockage rates; but to entitle any vessel to the benefit of this rule, her owner, consignee, or captain must apply to the Chief Wharfinger, who may assign her, in writing, a berth pursuant to such application. And in no case must the quarter rate commence before the date of the order assigning the berth, but must in every instance commence contemporaneously therewith, or at such a subsequent date as may be specified in the order.

26. The term "wharf" embraces every structure to which vessels make fast, or on which merchandise is discharged, or from which it is loaded.

— o —

RATES OF DOCKAGE

FOR THE PORT OF SAN FRANCISCO.

Each rate is for a day of twenty-four (24) hours, or any part thereof.

1. For all ocean vessels, steam or sail, and all sail vessels navigating the bay of San Francisco, and the rivers and other waters flowing into it, of 200 net registered tons or under, 2 cents per ton; for all such vessels of over 200 net registered tons, $4.00 for the first 200 tons, and ¾ of a cent for each additional ton.

2. For steamboats navigating the bay of San Francisco and the waters flowing into it, and used for carrying freight or passengers, of 200 tons or under, gross hull measurement, 2 cents per ton on such measurement; for such boats of over 200 tons gross hull measurement, $4.00 for the first 200 tons of such measurement, and ¾ of a cent for each additional ton.

3. For barges of 200 tons or under, 2 cents per ton; for barges over 200 tons, $4.00 for first 200 tons, and ¾ of a cent for each additional ton.

4. Vessels, while taking in cargo, or receiving or discharging ballast,

or lying idle, or occuping outside berths, or moored in docks, slips, basins or canals, are subject only to half rates of dockage ; *provided,* that vessels not used for carrying freight or passengers shall not be entitled to such half rates.

5. When the per diem dockage of a vessel, as above described, is not a multiple of five, it must be reduced or increased, as the case may be, to the nearest such multiple ; *provided,* that if it be equally near to two such multiples, it must be increased to the first such multiple above.

Rates of Dockage on Lighters.

A dockage rate of one cent per ton per day will be charged on all lighters in the following cases :

When discharging or loading at a wharf.

When discharging into or loading from a vessel lying at a wharf.

When transporting from a wharf to a vessel or from a vessel to a wharf, but one dockage charge will be made, and must be paid at such wharf.

When a lighter is charged or has paid dockage at a wharf for any day, she may use the same or any other wharf during that day without further charge, no matter how often she may leave and return, *provided* a receipt for payment at the first wharf be produced.

—— o ——

TOLLS.

A ton is : by weight, 2,000 pounds, unless otherwise specified ; by measurement, 40 cubic feet.

Merchandise, for the purpose of tolls and wharfage, must be estimated by weight or measurement, as the one mode or the other will give the greater number of tons.

Tolls per Load.

Tolls on *loads* hauled on or off a wharf are as follows :

On single loads (except where the article hauled is charged for otherwise than by the ton) of a ton or less.....	5 cents.
Of more than a ton, for each additional ton, or part of a ton, an additional.....	5 cents.

Tolls per Ton.

On merchandise (except where otherwise specified), per ton, 5 cents.
On hay discharged from a vessel on any wharf....per ton, 10 cents.
On hay hauled on to any wharf.....per ton, 5 cents.
On hay discharged from any vessel lying at any wharf, or in any slip, dock or basin, into another vessel, or received into any such vessel from any lighter or other vessel.....per ton, 5 cents.

On hay shipped from any wharf there are no tolls for such shipment, apart from those paid for discharging or hauling the hay on the wharf.

Of the following articles, 2,240 pounds constitute a ton :

Coal, Railroad Iron, Pig Iron, Gypsum, Asphaltum, Ores, Paving Stones, Sand and Ballast.

Agricultural Implements, to wit : Reapers, Mowers, Headers, Separators, Horse Rakes, Hay Presses, Plows, Cultivators and Wheeled Vehicles, when knocked down, will be taken by measurement.

On wheat or flour shipped from any wharf, no tolls will be collected for such shipment.

Tolls Charged otherwise than by the Ton.

On the following articles, tolls must be collected as follows :

On Fir, Redwood, Spruce, and all soft wood lumber, per thousand feet, board measure..... 5 cents.
On Oak, Hickory, Ash and all hardwood lumber, per thousand feet, board measure..... 10 cents.
On Lumber or Timber discharged in the water in any slip, dock, basin or canal, the same as if discharged on a wharf.
On Piles discharged in any slip, dock, basin or canal, per pile..... 3 cents.
On Fence Posts, per 100, or fractional part thereof..... 5 cents.
On Railroad Ties, per 1,000 feet of lumber, board measure, or fractional part thereof, contained therein..... 5 cents.
On Redwood Shingles, per 40 bundles, or fractional part thereof..... 5 cents.
On Cord Wood, per cord..... 5 cents.
On Tan Bark and Stave Bolts, per cord..... 10 cents.
On Bricks other than Fire Bricks, hauled or discharged on, or loaded from, any wharf, per 1,000, or fraction thereof, 10 cents.

On Bricks, other than Fire Bricks, discharged from any vessel lying at any wharf, or in any slip, dock, or basin, into another vessel, or received into any such vessel from any lighter or other vessel, per 1,000 or fraction thereof,	5 cents.
On Wool in Sacks, per sack	1 cent.
On Wool in Bales, strapped, per bale	1½ cents.
On Hops in bales, per bale	1 cent.
On Hides of Cattle (green or dried,) per hide	¼ cent.
On Sheep Skins, per skin	1-16 cent.
On Goat skins, per skin	1-16 cent.
On Deer Skins, per skin	1-16 cent.
On Seal Skins, per skin	1-16 cent.
On not specified Skins	1-16 cent.
On Cattle, Horses, and Mules, per head	5 cents.
On Colts and Calves under a year old, per head	2½ cents.
On Sheep and Hogs, per head	1 cent.
Reapers, Mowers, Horse Rakes, Hay Presses, Gang Plows, Cultivators and Wheeled Vehicles, set up, each	10 cents.
Headers and Separators, set up, each	20 cents.
On empty Barrels (merchandise), each	½ cent.
On empty Packages, being returned to the owner, who uses them to send commodities to market in, no tolls will be collected.	
On any package of merchandise carried by hand on to any wharf, and intended for sale	5 cents.

Tolls are due and payable on merchandise as soon as it is discharged from the vessel, and on merchandise for shipment as soon as it is placed on the wharf. Collectors must give no credit for tolls, unless authorized by the Board.

No tolls will be collected on donkey engines nor stevedores' tools, when taken on a wharf for the purpose of loading or discharging a vessel; nor on milk, butcher, baker, ice, or laundry wagons, on their daily trips to supply customers.

Merchandise landed on a wharf, and not removed therefrom, may be reshipped from the same wharf on the payment of one toll, and the wharfage, if any, due thereon.

Merchandise except hay and bricks, other than fire bricks, discharged from a vessel lying at any wharf, or within any slip, dock, basin, or canal, into lighters or other vessels, or received into any such vessel from lighters or other vessels, is subject to the same rates of toll as if discharged on a wharf or loaded from a wharf.

When the tolls have been paid on merchandise, on its discharge into lighters, it may be landed thence on a wharf without the payment of further tolls, except hay and bricks, (other than fire bricks) which shall be charged as follows: On hay, 5 cents per ton; on bricks, 5 cents per 1,000.

Merchandise must be removed from the wharf before six o'clock P.M. of the day following the one on which it is discharged or hauled thereon, except grain, beans and seeds from Sections 1 and 2 of the Sea Wall; but Wharfingers are hereby authorized, when the owners or consignees of merchandise desire it, and it can be done without interfering with the business of the wharf, to allow merchandise to remain on the wharf after the prescribed time, at a wharfage charge equal to an additional toll for every 48 hours or part thereof. If merchandise be not removed within 24 hours after notice by the Wharfinger, it shall be liable to the penalties of Section 2524 of the Political Code.

If tolls or wharfage be not paid on merchandise, as required by the regulations of the Board, it will be taken possession of, and two days thereafter will be removed and stored at the expense and risk of the owner or consignee, or sold at public auction. In such case the tolls or wharfage and ten per cent. thereon will be charged, together with all expense incurred in the removal and storage or sale.

Wharfage is the charge on merchandise for remaining on the wharf beyond the time it is allowed to remain in consideration of the toll paid for discharging.

No load exceeding five tons, except in the case of a single package, must be admitted on or off a wharf; and driving on a wharf faster than a walk is forbidden; and a violation of this rule shall subject the offender to prosecution for misdemeanor.

The Board is not liable for damages to or loss of merchandise while on a wharf.

Credit for Tolls and Wharfage.

Any person who may desire to obtain credit for tolls and wharfage must make application therefor to the Board, and must at the same time deposit with the Secretary the sum of $50, and if the application be granted, the Secretary shall immediately notify the different Collectors of the fact.

And every person who, in pursuance of such application shall be given such credit, must, on the first day of each month, pay into the office of the Secretary all bills due from him for tolls and wharfage for the previous month; or if said first day be a legal holiday, said payment must be made on the following day.

And for a failure to pay the amount due, as above required, the credit previously given shall cease, and the Secretary must immediately notify the Collectors of that fact, and deduct said amount from the deposit originally made, and apply the same to the payment of the amount due for tolls and wharfage, and the balance of said deposit, if any, shall be returned to the person who made it.

Rates of Toll and Wharfage on Grain, Beans and Seeds, at Sections 1 and 2 of the Sea Wall.

On grain, beans, and seeds, landed from vessels or hauled from other wharves, or from warehouses on Sections 1 or 2 of the Sea Wall, the tolls are, per ton, 5 cents.

Grain, beans, and seeds will be allowed to remain in the sheds, without further charge than the tolls for landing the same on the said wharves, *fifteen days* unless sooner ordered off by the Wharfinger. Of those fifteen days, they may remain three days on the front sixty-one feet of the wharf, unless sooner ordered back by the Wharfinger; if not sooner removed to the rear thirty-five feet of the sheds, they must be so removed at the end of three days above specified. If the owner or consignee of grain, beans or seeds shall prefer, he may cause them to be trucked to the rear thirty-five feet of the sheds at the time of their discharge.

On all grain, beans or seeds which shall remain in the sheds over fifteen days, there will be a wharfage charge of one cent a ton a day.

On all grain, beans or seeds ordered to be removed from the sheds, or from the front of the sheds to the rear, there will be imposed a penalty of ten cents a ton for each day they shall remain, after notice to remove them.

All handling of grain, beans or seeds in the sheds, pursuant to the above order, or in obedience to any order of the Wharfinger, must be at the expense of the owner or consignee.

All merchandise landed or hauled on Sections 1 or 2 of the Sea Wall, except that herein specified, will be subject to the regulations in force at other wharves.

The Commissioners hereby give notice to all whom it may concern, that they do not assume the duties or incur the liabilities of warehousemen, with respect to any produce or other merchandise landed on the Sea Wall or wharves.

Pilot Regulations of the Port of San Francisco.

Amendments to October, 1883.

EXTRACTS.

All vessels, their tackle, apparel, and the furniture, and the master and owners thereof, are jointly and severally liable for pilotage fees, to be recovered in any Court of competent jurisdiction.—*Political Code*, Sec. 2432.

Every pilot, on boarding a vessel, when required by the master thereof, must exhibit his commission as pilot. A refusal to do so subjects him to a forfeiture of his commission or license.—Sec. 2434.

Every pilot carried to sea against his will, or unnecessarily detained on board of a vessel, when a pilot boat is in attendance to receive him, is entitled to receive the sum of eight dollars per day while necessarily absent or detained, not to exceed in the aggregate the sum of one thousand dollars in any one case, which sum may be recovered by action against the master or owner of the vessel so taking him away.—Sec. 2435.

Every pilot in charge of a vessel arriving in the port or harbor of San Francisco must safely moor the vessel in such position as the master of the vessel or Harbor Master may direct. He must prevent all persons (except officers of the State or Federal governments, owners or consignees of the vessel or cargo, and persons admitted on the express orders of the master), from boarding such vessel until she has been safely moored. To enforce the provisions of this section, and other police regulations for the harbor, every pilot in charge of a vessel entering the harbor of San Francisco is authorized and empowered to arrest every one who, in opposition to the master's orders, persists in boarding such vessel, or who, having boarded her, refuses to leave on command of such master or pilot. When so arrested, he must be immediately brought before the Police Judge's Court, or admitted to bail, as provided in the Penal Code.—Sec. 2159.

The pilotage inside the heads to the anchorage opposite San Francisco, and about the harbor, or between the harbor of San Francisco and the ports of Mare Island, Vallejo, or Benicia, must be at such rates as agreed on between the parties, not to exceed five dollars per foot draught.—Sec. 2465.

The following shall be the rates of pilotage into or out of the harbor of San Francisco: Vessels under five hundred tons, five dollars per foot draught; all vessels over five hundred tons, five dollars per foot draught and four cents per ton for each and every ton of registered measurement. Vessels engaged in the whaling or fishing trade shall be exempt from all pilotage, except when a pilot is actually employed. When a vessel is

spoken, inward or outward bound, and the services of a pilot are declined, one-half of the above rates must be paid. In all cases where inward bound vessels are not spoken until inside of the bar, the rates of pilotage must be reduced fifty per cent.—Sec. 2466.

Any vessel in tow of a steam-tug between the harbor of San Francisco and the ports of Mare Island, Vallejo, or Benicia, shall be exempt from all charges for pilotage, unless a pilot is actually employed.—Sec. 2467.

All vessels coasting between San Francisco and any port in Oregon, or in Washington or Alaska Territories, and all vessels coasting between ports of this State, are exempt from all charges for pilotage, unless a pilot is actually employed.—Sec. 2468.

If any pilot, in endeavoring to assist or relieve any vessel in distress, suffers loss or damage in his boats, sails, tackle, rigging, or appurtenances, the master, owner, or consignee of such vessel must pay the value of such loss or damage, to be ascertained by the Commisioners.—Sec. 2433.

When cruising off or standing out to sea, pilots must go to a vessel nearest to shore, or in the most distress, under a penalty of one hundred dollars. For refusing to go on board a vessel when required, a like penalty may be imposed.—Sec. 2437.

When two or more pilots shall offer their services to any vessel inward bound, the pilot first offering, or one connected with the same boat, shall have preference ; and if the services of another be accepted, the vessel, her appurtenances, and the master and owner thereof, shall be jointly and severally liable to the pilot entitled to such preference for one-half the amount of pilotage he would have been entitled to had his services been accepted.

Any pilot bringing a vessel into the harbor (or one connected with his boat) shall be entitled to take such vessel to sea again when she departs ; *provided*, such pilot and those connected with his boat have not in the meantime become in any manner disqualified or incapacitated ; and if such preference be disregarded by the master of such vessel, the vessel, master and owner shall be liable to the pilot entitled to such preference for one-half the amount to which he would be entitled if his services were accepted.

o

Quarantine Laws for the Harbor of San Francisco.

Amendments to October, 1888.

The quarantine grounds of the bay and harbor of San Francisco are at the anchorage of Saucelito.—*Political Code*, Sec. 3004.

Shipmasters bringing vessels into the harbor of San Francisco, and

masters, owners, or consignees having vessels in the harbor, which have on board any cases of Asiatic cholera, small pox, yellow fever, typhus or ship fever, must report the same in writing to the Quarantine Officer before landing any passengers, casting anchor, or coming to any wharf, or as soon thereafter as they, or either of them, become aware of the existence of these diseases on board of their vessels.—Sec. 3013.

No captain or other officer in command of any vessel sailing under a register, arriving at the port of San Francisco, or any owner, consignee or agent in charge of such vessel, must, under a penalty of not less than one hundred dollars, nor more than one thousand dollars, land, or permit to be landed, any freight, passengers, or other persons from such vessel, until he has reported to the Quarantine Officer, presented his bill of health, and received a permit from that Officer to land freight, passengers or other persons.

Every pilot who conducts into the port of San Francisco any vessel subject to quarantine or examination by the Quarantine Officer, must:

First.—Bring the vessel no nearer the city than is allowed by law.

Second.—Prevent any person from leaving, and any communication being made with, the vessel under his charge, until the Quarantine Officer has boarded her, and given the necessary orders and directions.

Third.—Be vigilant in preventing any violation of the quarantine laws, and report without delay all such violations that come to his knowledge to the Quarantine Officer.

Fourth. Present the master of a vessel with a printed copy of the Quarantine laws, unless he has one.

Fifth. If the vessel is subject to quarantine, by reason of infection, place at the mast-head a small yellow flag.—Sec. 3015.

Every master of a vessel subject to quarantine, or visitation by the Quarantine Officer, arriving in the port of San Francisco, who refuses or neglects either:

First—To proceed with and anchor his vessel at the place assigned for quarantine, when legally directed so to do; or,

Second—To submit his vessel, cargo and passengers to the Quarantine Officer, and furnish all necessary information to enable that officer to determine what quarantine or other regulations they ought respectively to be subject to; or,

Third—To report all cases of disease and death occurring on his vessel, and to comply with all the sanitary regulations of the bay and harbor; is liable in the sum of five hundred dollars for every such neglect or refusal.

All vessels arriving off the port of San Francisco from ports which have been legally declared infected ports, and all vessels arriving from

ports where there is prevailing at the time of their departure any contagious, infectious or pestilential disease, or vessels with decaying cargoes, or which have unusually foul or offensive holds, are subject to quarantine, and must be by, the master, pilot, owner, or consignee, reported to the Quarantine Officer without delay. No such vessel must cross a right line drawn from Meiggs' Wharf to Alcatraz Island, until the Quarantine Officer has boarded her, and given the order required by law.—Sec. 3017.

The Quarantine Officer must board every vessel subject to quarantine and visitation by him immediately on her arrival; make such examination and inspection of vessel, books, papers or cargo, or of persons on board, under oath, as he may judge expedient, and determine whether the vessel should be ordered to quarantine, and if so, the period of quarantine.—Sec. 3018.

No captain, or other officer in command of any passenger-carrying vessel of more than one hundred and fifty tons burden, having passengers on board, nor any owner, consignee, agent, or other personhaving charge of such vessel or vessels, must, under penalty of not less than one hundred dollars nor more than one thousand dollars, land, or permit to be landed, any passenger from the vessel, until he has presented his bill of health to the Quarantine Officer, and received a permit from that officer to land such passenger, except in such cases as the Quarantine Officer deems it safe to give the permit before seeing the bill of health. —Sec. 3019.

The following fees may be collected by the Quarantine Officer. For giving a permit to land freight or passengers, or both, for any sailing vessel less than five hundred tons burden from any port out of this State, two dollars and fifty cents; over five hundred and under one thousand tons burden, five dollars; each additional one thousand tons burden, or fraction thereof, an additional two dollars and fifty cents; for steam vessels propelled in whole or in part by steam, of one thousand tons burden or less, five dollars, and two dollars and fifty cents additional for each additional one thousand tons burden or fraction thereof; but vessels not propelled in whole or in part by steam, sailing to or from any port or ports of the Pacific States or Territories, and whaling vessels entering the Harbor of San Francisco, are excepted from the provisions of this Section.—Sec. 3020.

The Board of Health may enforce compulsory vaccination on passengers in infected ships, or coming from infected ports.—Sec. 3021.

HARBOR POLICE SIGNALS.

Between sunrise and sunset the National flag in the mizzen rigging; and between sunset and sunrise a green or blue light, at least twelve feet above deck.

Port Wardens.

It is the duty of the *Port Wardens* to survey the hatches, stowage and cargo of all vessels arriving at the port of San Francisco, laden with general or assorted merchandise, belonging to or consigned to various parties; also to survey all vessels arriving in distress, or which have sustained damages at sea, whether to sails, rigging, spars, hull or otherwise, caused by stress of weather, stranding, collision, or other accident.

A penalty of not less than five hundred or more than one thousand dollars is imposed for the violation of the law under which the Port Wardens act (which provides that none but Port Wardens shall hold surveys); they will, however, in marine surveys, recognize and co-operate with such parties as may be designated by representatives of foreign goverments, underwriters, and owners or consignees of vessels.

—— o ——

Passenger Act of the State of California.

The Passenger Act of the State of California requires *all masters or commanders of vessels, arriving from ports outside the State of California,* to make report to the Commissioner of Immigration within twenty-four hours after arrival. This report is to contain the names, ages, sex, nationality and occupation of all persons or passengers on board, not citizens of the United States. Masters or commanders of vessels are to require all persons claiming to be naturalized citizens to make oath or affirm the same, giving the time and place where such naturalization took place.

Special bonds are required for all "lunatic, deaf, dumb, blind, crippled or infirm persons, whose circumstances make it probable they will become a burden on the State." The penalty for non-report is $200, and $200 per alien passenger not reported.

—— o ——

Subaqueous Telegraph Cables in San Francisco Harbor.

For full description of the routes and landings of the cables of the Western Union, Sunset Telephone-Telegraph, and Pacific Postal Telegraph, see page 143 of advertisements.

Pilot Act for Columbia River and Bar.

CONDENSED.

The *Bar* pilotage ground extends from the uppermost dock or wharf at Astoria or Knapton to the open sea, at least ten miles beyond the outermost buoy.

The *River* pilotage ground extends from the lowermost dock or wharf at Astoria to the head of navigation on the Columbia and Willamette Rivers and their tributaries.

The *Branches* or *Warrants* issued to pilots shall define the grounds covered by such pilot's authority, and the fees to which he is entitled.

Tho Board of Pilot Commissioners have power to carry out the provisions of this Act, to secure an efficient pilot service, to hear and determine complaints against pilots, issue subpœnas for witnesses, compel attendance, administer oaths, etc.

No bar-pilot license shall be issued to the owner, or any person in the employ of any steam tug-boat.

A complaint against the pilot must be in writing, and verified as a complaint in a civil action.

The bar pilots shall at all times cruise outside the bar, unless prevented by tempestuous weather.

A pilot boarding a vessel must, if requested by the master, exhibit his license, before he is authorized to act as a pilot therein.

A pilot on the bar-pilot grounds must speak inward bound vessels in the order of their coming to the bar, and take the first vessel spoken who desires his services, except there is a vessel in immediate danger, and then such vessel must be first spoken and taken, until placed out of danger.

A pilot who brings a vessel in over the bar is entitled to pilot her to sea, when next she leaves the river (unless meanwhile he becomes disqualified); but if the master or owner desires another pilot, the Board may allow him to take one from the same boat.

A pilot who first speaks a vessel of over 100 tons burden, within his own pilotage ground, and offers his services, is entitled to pilot such vessel, whether over the bar, or up or down the Columbia or Willamette rivers. If his services are rejected, he is entitled to recover full pilotage from vessels inward bound over the bar, and half pilotage from vessels outward bound over the bar. From vessels over 100 tons on the river ground, going either up or down, he can recover full pilotage, if his services are rejected.

In the following cases a vessel is exempt from compulsory pilotage and not required to pay a pilot unless one is employed: (1) A vessel

engaged in the whaling or fishing trade. (2) A vessel licensed and engaged exclusively in the coasting trade, between any port in Oregon and any port on the Pacific Coast.

Rates of Pilotage.

Bar Pilots, for piloting an inward or outward bound vessel to or from Astoria, over the bar, or from within the bar to the open sea, *six* dollars a foot for the first twelve feet, and *eight* dollars for each additional foot. From or within the bar, and below Sand Island, one-half that rate; and from or above Sand Island, one-quarter that rate.

River Pilots, for piloting a vessel between Astoria and Portland, whether ascending or descending, *three* dollars per foot draught. For service between other points, the Board is authorized to prescribe a proportionate compensation.

Between the 31st of October and the first of April, *ten* dollars shall be allowed (in addition to the pilotage) for piloting a vessel over the bar, whether outward or inward bound.

When an outward bound vessel is prevented by stress of weather from going to sea, and the pilot remains on board at the request of the master, he shall be entitled to an additional compensation of *five* dollars per day for such detention.

A pilot carried to sea by a vessel under his charge, without justifiable cause, is entitled to $150 a month during his necessary absence.

The master, owner, consignee, or agent of a vessel are jointly and severally liable to the pilot (as well as his lien upon the vessel), for any sum due to him for piloting, or offering to pilot, such vessel.

Act of Congress in relation to Coloring, Numbering and Placing Beacons, Buoys, Spindles, Stakes, etc.

In conformity with Section 4678 of the Revised Statutes of the United States, the following order is observed in coloring and numbering the buoys along the coast, or in bays, sounds, channels, or harbors of the United States, viz:

1. In approaching the channel, etc., from seaward, RED BUOYS WITH EVEN NUMBERS, will be found on the STARBOARD side of the channel, and must be left on the STARBOARD hand in passing in.

2. In approaching the channel, etc., from seaward, BLACK BUOYS, WITH ODD NUMBERS, will be found on the PORT side of the channel, and must be left on the PORT hand in passing in.

3. BUOYS painted with RED and BLACK (horizontal) STRIPES will

be found ON OBSTRUCTIONS, with channel-ways on either side of them, and may be left on either hand in passing in.

4. Buoys painted with white and black (perpendicular) STRIPES will be found in MID-CHANNEL, and must be passed close to, to avoid danger.

5. All other distinguishing marks to buoys will be in addition to the foregoing, and may be employed to mark particular spots, a description of which will be given in the printed list of Buoys.

6. Perches with balls, cages, etc., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

Penalty for willful injuring, a fine not to exceed one thousand dollars on conviction.

—— o ——

SAILING DIRECTIONS FOR HARBORS ON WEST COAST OF UNITED STATES.

ALSO, LIST OF BUOYS AND BEACONS

MARKING THE COAST FROM SAN DIEGO TO OLYMPIA, IN PUGET SOUND.

Corrected from the U. S. Lists of 12th and 13th Light-house Districts, up to October, 1888.

Bearings by compass; depth of water at lowest tides; distances in nautical miles.

San Diego Harbor.

There are 21 feet at low water in the channel across the bar, which is generally very smooth.

Sailing Directions—Point Loma and the Coronades Islands, also Table Mountain, form good landmarks for the entrance to the bay. The kelp, also, which extends from False Bay along the land to 3 miles beyond Point Loma, will serve as a guide in thick weather. Vessels entering the port may pass through the kelp, keeping at least one-half mile to the southward of the point until clear of the eastern edge of the kelp, then steer N. by E. $\frac{1}{8}$ E. for the outside mid-channel buoy, and pass a little to the starboard of it; then steer N. by E. for the inside mid-channel buoy, distant one-half mile, passing it close to; from this buoy steer N. W. by N. $\frac{7}{8}$ N. for Ballast Point; haul close up to the point, especially if ebb tide. From this point deep draught vessels will find a good channel by hauling close around Ballast Point, until abreast La Playa, after which the channel is closely defined by beacons, the course

being midway between them to new San Diego. Light draught vessels may, from Ballast Point, steer N. W. by N. $\frac{7}{8}$ N. until nearly abreast La Playa, after which the course is midway between the beacons.

New Buoys—A perpendicular stripe buoy has been placed near the end of the kelp 2½ miles S. ¾ E. from Point Loma in 14½ fathoms.

A bell buoy has been placed ½ mile S. by W. ⅛ W. from the southernmost of the two P. S. buoys marking the bar at the entrance of the bay, and in range with those two buoys.

The bell buoy lies 1⅛ miles S. S. E. ½ E. from Point Loma lighthouse.

A new horizontal stripe, red and black spar buoy has been placed just inside Ballast Point, to mark the south end of Middle Ground Shoal.

Black buoy No. 1, lying about ¼ mile N. W. ½ N. from Ballast Point, has been removed, and a new H-S buoy, red and black, has been placed in 18 feet water at the upper end of Middle Ground Shoal, ½ mile N. N. W. from Ballast Point. A H-S spar buoy, red and black marks the lower end of the shoal.

Outside Mid-Channel Buoy—First-class nun buoy; black and white perpendicular stripes, placed in 33 feet water. Hard, sandy bottom. Point Loma lighthouse bears N. W. by W.; Ballast Point, N. by W. ¾ W.; Inside mid-channel buoy, N. ¾ E., distant half a mile.

This buoy must be passed close to, as the channel is narrow.

Inside Mid-Channel Buoy—First-class nun buoy; black and white perpendicular stripes, placed in 33 feet water. Point Loma lighthouse bears W. by N.; south end of island, N. E. by E. ½ E.; Ballast Point N. N. W. ¼ W.

In mid-channel, and must be passed close to on either side.

New Beacons—A single pile diamond beacon, painted black, on the port side of the channel, in 6 feet water, between Nos. 3 and 5. No. 4 beacon bears S. S. E. ½ E.; No. 6, E. N. E. ¾ E.

A single pile double cross beacon, painted red, on the starboard side of the channel, in 6 feet water, between No. 6 and the red diamond beacon; No. 6, S. W. by W. ⅞ W.; No. 5, W. ⅜ N.

A single pile double cross beacon, painted black, in 5 feet water, on edge of Dutch Flat, between Nos. 5 and 7. No. 5 beacon, W. S. W. ¾ W.; No. 8, S. E. by E. ¼ E.

New Beacons—A single-pile diamond beacon, painted black on the port side of the channel, in 6 feet water, between Nos. 3 and 5 beacons; No. 4 beacon S. S. E. ½ E.; No. 6 beacon E. N. E. ¾ E. A single pile double cross beacon, painted red, on the starboard side of the channel, in 6 feet water, between No. 6 and the red diamond beacon; No.

6 beacon S. W. by W. ⅞ W.; No. 5 beacon W. ⅜ N. A single pile double cross beacon, painted black, in 5 feet water, on edge of Dutch Flat, between Nos. 5 and 7; No. 5 beacon W. S. W. ¾ W.; No. 8 beacon S. E. by E. ¼ E.

Four spar buoys have been placed to mark the channel between San Diego and National City. These buoys lie about as follows from the red beacon at the N. E. end of the island: a red buoy E. by S. 1,100 yards; a black buoy E. ¾ S. 2,000 yards; a red buoy E. S. E. ⅞ E. 2,800 yards; a black buoy E. by S. 2,950 yards.

A red day beacon has been placed a little over 1½ miles W. S. W. ⅞ W. from the northern pier of the city of San Diego, and a black day beacon 1 1-10 miles W. from the same pier.

No. 2—Pile beacon crowned with box, painted red, in 10 feet water. Beacon No. 3 bears N. W. ⅞ W.; Buoy No. 1, S. ¾ W.; Beacon No. 4, N. E. by N.

This beacon marks the shoal on starboard side of channel. After passing Buoy No. 1, steer between Beacons Nos. 2 and 3, and when opposite La Playa, anchor in from 6 to 9 fathoms.

No. 3—Pile beacon crowned with box, painted black, in 9 feet water. Ballast Point bears S. by E. ¼ E.; Beacon No. 4, N. E. ¾ E.; Beacon No. 2, S. E. ⅞ E. Placed in hard, sandy bottom. Here the channel turns very suddenly, and care should be taken to keep in mid-channel if bound to New Town, following the beacons on starboard hand.

No. 4—Pile beacon crowned with box, painted red, in 9 feet water. Beacon No. 6 bears N. E.; Beacon No. 5, N. by E. ⅝ E.; Beacon No. 3, S. W. ¾ W. Placed in hard, sandy bottom.

No. 5—Pile beacon crowned with box, painted black, in 9 feet water. Soft, muddy bottom. Beacon No. 7 bears E. ¼ N.; Upper end Horton's wharf, E. ¾ S.: Beacon No. 4, S. by W. ⅝ W.

No. 6—Pile beacon crowned with box, painted red, in 9 feet water. Beacon No. 7 bears E. by N. ¼ N.; Beacon No. 5, N. by W. ½ W.; Beacon No. 4, S. W. Placed in hard, sandy bottom. Inside the beacon it is bare at low water.

No. 7—Pile beacon crowned with box, painted black, in 9 feet water. Horton's wharf bears S. E. by E. ½ E.; Beacon No. 8, S. E. ¼ E.; Beacon No. 6, W. S. W. ¾ W. Placed on a small shoal near Culverwell's old wharf, in soft, muddy bottom.

Single pile beacon crossed by boards, painted red, in 14 feet water. Point Loma light bears S. S. W. ⅝ W.; Beacon No. 8, E. S. E. On starboard side of channel, about midway between Beacons Nos. 6 and 8.

No. 8—Pile beacon crowned with box, painted red, in 10 feet water. Beacon No. 7 bears N. W. ¼ W.; Horton's wharf, N. by W. ¼ W.; Point Loma light S. W. by W. Placed nearly opposite Horton's wharf. After passing this beacon the water is narrow and shoal.

Single pile beacon crossed by boards, painted with black and red horizontal stripes, in 13 feet water. Point Loma light, S. W. by W. ⅝ W.; R. R. Co.'s wharf, S. E. by E. ¼ E. Marks the 12 foot spot on south middle ground. Vessels can pass on either side of it.

Single pile beacon crossed by boards, painted with black and red horizontal stripes, in 12 feet of water. Lighthouse bears S. W. by W. ⅝ W.; R. R. Co.'s wharf, S. E. ½ E. Marks 12 foot spot on north middle ground. Vessels can pass on either side of it.

No. 9—Single pile beacon crossed by boards, painted black, in 13 feet water. Lighthouse bears W. by S. ¾ S.; R. R. Co.'s wharf, S. E. by S. On north or port side of channel, to be left on port side going in.

No. 10—Single pile beacon crossed by boards, painted red, in 13 feet water. Lighthouse bears W. by S. ¼ S.; R. R. Co.'s wharf, S. E. by E. On south side of channel, to be left on starboard side going in.

No. 12—Single pile beacon crossed by boards, painted red, in 13 feet water. Lighthouse bears W. by S.; R. R. Co.'s wharf, E. S. E. On south side of channel, nearly up to R. R. wharf; to be left on the starboard side going in.

Wilmington Harbor, Cal.

There is an average depth of 9 feet at low water at the entrance.

Sailing Directions—From the anchorage in San Pedro Bay steer W, N. W. for the entrance, so as to pass between Buoys No. 1 and No. 2. Turning with port helm, leave Buoy No. 2 on the starboard side, about 150 feet distant. When Buoy No. 2 is abeam, steer N. N. W. ½ W. for Buoy No. 4; leave this buoy close to on the starboard side, and steer N. W. ¼ W. for the railroad wharf.

Wilmington Roads, San Pedro Bay—A bell buoy, with black and red horizontal stripes. Center of Deadman's Island bears W. N. W. ¼ W.; Point Fermin light S. W. ½ W. This buoy is placed in 5 fathoms water, 75 yards south of a rock which has 18 feet water on it, and probably not more than 16½ feet at low water springs. It lies inside of a patch of kelp.

A third class nun buoy painted green and marked "Wreck" has been placed 58 feet south of a sunken lighter, which lies 300 feet S. W. of Deadman's Island.

Buoy No. 1—Second-class nun buoy, painted black, placed in 10 feet water. Deadman's Island bears N. ¼ E., distant 900 feet; must be left to port in entering the harbor.

Buoy No. 2—Second-class can buoy, painted red, placed in 10 feet water. Deadman's Island bears N. N. E. ¼ E., distant 250 feet. Must be left to starboard in entering the harbor.

Buoy No. 4—Second-class can buoy, painted red, placed in 15 feet water, near the end of the wing dam, on the starboard side of the channel, about half way from the entrance to the S. P. Railroad wharf. Must be left to starboard going up to Wilmington.

Two spar buoys have been placed on the edge of the west training wall, one at the extreme outer end and one at the elbow. Must be left on the port side going in.

Beacon No. 3—Single pile beacon crossed with boards, painted black. R. R. wharf bears N. W. by W.; Timms' wharf, S. ½ E. Placed on shoal near the end of Railroad wharf. Must be left on port side going up to Wilmington.

Beacon No. 4—Single pile beacon crossed with boards, painted red. S. P. R. R. wharf bears N. W. by W.; Timms' wharf, W. S. W. ¼ W. Placed near the end of wing dam on the starboard side of channel, about half way from entrance to S. P. R. R. wharf. Must be left to starboard going up to Wilmington.

Point Arguello.

Whistling Buoy—Painted with black and white perpendicular stripes. Placed in 17 fathoms water, on the following range and bearing, Coast Survey signal on Point Arguello in range with sharp peak N. N. E.

Port Harford, San Luis Obispo.

San Luis Obispo Buoy—Second-class whistling buoy, black and white perpendicular stripes. Pecho rock bears N. W. by W. ⅞ W., distant 4⅛ miles; Whaler Island, left tangent, N. W. ¾ W.; White rock in range with Souza rock, in line with fence N. N. E. Placed in 19 fathoms of water, and marks the entrance to Port Harford. The whistle is sounded by the action of the sea, and gives from 20 to 30 blasts a minute.

No. 1. First-class Nun Buoy—Painted black, placed in 12½ fathoms of water, and marks an 18-foot spot to the southward and westward of Point San Luis. Whaler Island bears N. E. ⅛ E.; Pecho

rock, N. W. ¾ W.; whistling buoy, E. ½ S. Must be left on port side going S., and on the starboard side going N., 1⅝ miles from Whaler Island.

No. 2. Second-class Can Buoy—Painted red, marks a 14-foot spot 1 3-16 miles to the eastward of Whaler Island; lies in 9½ fathoms water, with White Rock bearing N. E. ⅝ E.; Avila rock, N. ⅜ E; Whaler Island, W. ½ S. Must be left on starboard side going into San Luis Obispo Bay.

Cayucos Landing.

A second-class can buoy, painted black and numbered 1, has been placed in 8 fathoms water, about 4 fathoms Southeast of Mouse Rock. A black spar buoy has been placed in 5 fathoms water, between the can buoy and High bluffs, off the eastern end of a rocky ledge, and a red spar buoy has been placed in 5 fathoms water, off the western end of a rocky ledge, called Metcalf rocks, on the east side of the entrance.

Piedras Blancas.

A whistling buoy, with black and white vertical stripes, has been placed in 14 fathoms of water, ⅜ of a mile S. W. by W. ¾ W. from Piedras Blancas, in range with Light House tower, just open to the northward of the highest point of the rock.

Point Sur, Cal.

Point Sur Buoy—Whistling buoy, black and white perpendicular stripes. Point Sur bears N. E. ½ N. Placed in 141 feet water, opposite Point Sur. It can be passed close to on either side. The whistle is sounded by the action of the sea, and gives from 20 to 30 blasts a minute.

Point Pinos—Monterey Bay.

A whistling buoy, black and white vertical stripes, has been placed off Point Pinos, in 20¼ fathoms of water, in range with outer White rock and Point Pinos Lighthouse. Outer White rock bears S. E. ½ E., distant ⅜ mile; Aumentos rock E. S. E. ¾ E.; Point Pyramid S. ½ W., distant 2¼ miles.

Santa Cruz Harbor.

A whistling buoy, black and white vertical stripes, has been placed off Santa Cruz in 10 fathoms water. Point Soquel bears N. E. ⅜ E., dis-

tant 1⅝ miles; P. C. S. S. Co.'s wharf, N. W. ⅝ W. distant 1⅝ miles; Santa Cruz lighthouse W. N. W. ¾ W., distant 1⅜ miles.

Half Moon Bay, Cal.

Sailing Directions—Bring Amesport wharf or Widow Wood's house to bear N. E. by N. and steer for it, passing midway between Buoy No. 1 (black) on Pillar Point reef, and Buoy No. 2 (red) on northern end of S. E. reef; haul up gradually into the bay, and anchor in from 4 to 9 fathoms. Approaching from the southward, give Buoy No. 3 (black) on the southern end of Southeast reef a good berth to port, and proceed as before. This bay is a good summer anchorage, but exposed to the full force of wind and sea in winter

Pillar Point Reef Buoy—Second-class can buoy, No. 1, painted black, in 42 feet water. Sail rock bears N. W. by W. ¾ W.; old wharf just inside Pillar Point, N. W.; Amesport wharf, N. E. ⅛ N. Marks the point of Pillar Point reef.

Southeast Reef Buoy—(Northern end). Second-class can buoy, No. 2, painted red, in 30 feet water. Amesport wharf bears N. N. E.; Sail rock, N. W. ¾ W. Marks the northern end of Southeast Reef.

Southeast Reef Buoy—(Southern end). Second-class can buoy, No. 3, painted black, in 36 feet water. Amesport wharf bears N. ⅝ E.; Sail rock, N. W. ¾ W. Marks the southern end of Southeast Reef.

San Francisco Bay and Harbor.

There is an average depth of 5 fathoms at low water on this bar.

Sailing Directions.—*Coming from the southward*, it is usual to make the coast at or near Año Nuevo Island, upon which there is a steam fog whistle. When about eight miles off this island, steer N. N. W. ¼ W. until abreast Point San Pedro, and about five miles off, then steer N. ⅛ E. from Point Bonita light, until Alcatraz light is just open on Fort Point light, when you must change course to N. E. by E. ½ E.; continue this course, leaving the buoy on Fort Point ledge a good berth to starboard, until the south end of Yerba Buena Island bears E. ½ N.; now steer E. ¼ N. until abreast Alcatraz light. (This course clears Blossom Rock.) From abreast Alcatraz steer E. S. E. along the wharves, and anchor in 10 fathoms.

Coming from the Westward—First sight the South Farallon Island or light; leave this to the northward; being up with this light, steer N. E. by E. for the whistling buoy off the bar, or until Alcatraz

Island or light is just open on Fort Point light; then steer N. E. ½ E. and leave the buoy on Fort Point ledge to starboard. When abeam of Fort Point, steer N. E. by E. ½ E. until the south end of Yerba Buena Island bears E. ½ N., and proceed as before.

Coming from the Northward and Westward—Make Point Reyes light, pass it two miles off, and steer E. S. E. ¼ E. for the whistling buoy off the bar, or until Alcatraz Island or light is just open on Fort Point light, and then proceed as before.

Directions for Foggy or Thick Weather—Strangers approaching the entrance during thick weather should do so with the greatest caution, carefully sounding at the same same. The line of 150 fathoms is only distant 5 miles from the South Farallon, 24 miles from Point San Pedro, 18 miles from Pigeon Point, and 17 miles from Año Nuevo Island. Vessels should avoid the near vicinity of the North and Middle Farrallons, as the soundings are deceptive; and to avoid Noonday Rock should be very careful not to open the North and South Farallons to the southward. The fog signals on Point Reyes, Farallon, Point Bonita, Point Montara, Pigeon Point and Año Nuevo are all distinctive, and their characteristics should be carefully studied, which, if done, will serve as excellent guides in thick weather. Coasters familiar with the entrance often work their way to the bar and entrance by the feg signals and soundings; but strangers should keep well off shore, and await clear weather and a pilot.

Noonday Rock Buoy is now marked by a horizontal striped bell buoy lying 100 yards W. ¾ N. from it.

To avoid Noonday Rock, mariners should be very careful not to open the North and South Farallons to the southward, and in foggy weather keep in not less than 50 fathoms.

Duxbury Reef Buoy—Fist-class can buoy, red and black horizontal stripes. Point Bonita Lighthouse bears E. ⅛ S.; Point Reyes Lighthouse, W. by N.; Farallon Lighthouse, S. W. ⅜ S.; Duxbury Point, N. N. W. ⅜ W.

This buoy marks Duxbury Reef, and is placed 2⅛ miles S. E. by S. from Duxbury Point, in rocky bottom, 12 fathoms water.

Outside Bar Buoy—Whistling buoy, black and white perpendicular stripes. Point Bonita Lighthouse bears N. E. ⅛ E., distant 7⅛ miles; Inner Bar Buoy, N. E. by E., distant 4⅜ miles; peak of Table Mountain, N. ⅝ E.; Fort Point and Alcatraz Lights in range.

This buoy is placed outside the bar, in 15¾ fathoms, sandy bottom, and may be passed close to on either side. In ordinary smooth sea the buoy can be heard at a distance of a mile; in a heavy sea, much farther.

The whistle is sounded by the action of the sea, and gives from 20 to 30 blasts a minute.

South Shoal Buoy—First-class nun buoy; black and red horizontal stripes. Point Bonita Lighthouse bears N. N. E.; Seal Rock, N. E.; Fort Point and Mile Rock in one, N. E. ½ N. This buoy lies on a small shoal just inside the bar, in 39 feet water, and should be given a berth of half a mile on either side. Just inside the buoy it breaks whenever there is a heavy swell on the bar.

Wreck of Escambia—Third-class nun buoy, painted green, and marked "Wreck." Wreck bears from the buoy N. N. E., 49 feet distant; may be passed on either side, giving it a wide berth (will soon be removed).

West End of Four Fathom Bank—First-class nun buoy, No. 1, painted black. Seal Rock bears E. ⅜ S.; Buoy east end Four-Fathom Bank, E. N. E., distant 3⅛ miles; Point Reyes, W. N. W. ¾ W.

This buoy is placed on the west end of Four-Fathom Bank, in 30 feet water, sandy bottom. Vessels coming from the north in smooth weather may cross the bar by leaving this buoy on the port side, and then steer east for Point Lobos, until in line with Fort Point and Alcatraz Island, and then steer for buoy between the Heads.

Inside Bar Buoy—First-class nun buoy, black and white perpendicular stripes. Ballenas Point bears N. W. by W. ¼ W.; Seal Rock, E. ½ N.; Buoy between the Heads, N. E. by E. ¼ E., distant 2½ miles.

This buoy is placed inside the bar in 57 feet water, sandy bottom, and may be passed close to on either side.

East End of Four-Fathom Bank—First-class nun buoy, No. 3, painted black. Fort Point Lighthouse bears E. N. E. ¾ E.; Point Bonita Lighthouse, N. E. by E. ⅛ E.; Seal Rock, S. E. by E. ⅛ E.

This buoy is placed on the east end of Four-Fathom bank, in 39 feet water. Give it a good berth.

Bonita Channel—First-class nun buoy, No. 2, painted red. Point Bonita light bears E. S. E. ¾ E.; Seal Rock, S. E. ½ E. Placed on north side Four-Fathom bank, west of entrance to Bonita Channel.

Bonita Channel—First-class nun buoy No. 3, painted black. Point Bonita light bears S. E. by E. ⅞ E.; Seal Rock, S. E. ⅛ E.; Buoy No. 1, S. W. ¾ W.; Rocky Point, W. N. W. Placed on the east side of Bonita Channel, to mark a spit nearly off the Rodeo Lagoon.

In passing Fort Point a good berth should be given, as the ebb tide is very strong and irregular, and sets directly upon it, making a very dangerous eddy between it and Mile Rock, for which reason the north side should have the preference.

Fort Point Ledge—Iron spar buoy, painted red. Point Diablo bears W. ¾ N ; Lime Point, N. by W. ⅞ W.; Seal Rock, S. S. W. ¼ W.

This buoy, placed in 30 feet water, should be given a good berth, for the ebb tide sweeps in on the ledge with great force.

Presidio Shoal—Second-class can buoy, red and black horizontal stripes. Fort Point bears S. W. by W. ½ W.; Anita Rock, S. S. E. ½ E.; Alcatraz Lighthouse, N. E. ½ E.

This buoy is placed near the middle of the shoal in 21 feet water. All vessels may pass in safety on either side by giving it a berth of fifty yards.

Yerba Buena Island—A first-class can buoy, red and black horizontal stripes, has been placed at the north end of the shoal, in 21 feet water.

Anita Rock—Iron spindle crowned with round cage and glass ball, black and red horizontal stripes. Fort Point Lighthouse bears W. ⅞ S.; Alcatraz Lighthouse, N. E. ½ N., distant 1¾ miles.

This spindle is placed on the rock, which is bare at low water. To be left on the starboard side in entering, but may be passed on either side by small vessels.

Buoy on Wreck of "Autocrat"—Third-class spar buoy, painted green and marked "WRECK," lying about 200 yards westward of Alcatraz Island, in 24 feet water.

Blossom Rock Buoy.—Second-class can buoy, red and black horizontal stripes. Alcatraz Lighthouse bears W. by N.; Fort Point Lighthouse, W. S. W.; south end of Yerba Buena Island, E. ⅜ S.; east side Angel Island, N. N. W. ½ W. Anchored in 22½ feet water, and should be given a good berth on either side, owing to the heavy tide-rips in that locality.

Mission Bay Rock.—Third-class nun buoy, black and red horizontal stripes. There is a depth of 12½ feet on the rock at mean low water. The buoy is placed near the shoalest part of the rock, and may be passed on either side by giving it a good berth.

Sonoma Rock.—Third-class nun buoy, black and red horizontal stripes. Mission Rock bears N. by W. Placed in 14 feet water, off the end of the oil wharf in Mission Bay.

San Antonio Creek—Five 30-foot spar buoys, painted red, are moored at the south edge of the "Cut" ; they are about 200 yards apart. There is but 8 feet outside ; must be left on the starboard side going in the creek.

San Antonio Creek.—Single pile beacon, crossed with boards, painted red. Marks a shoal on the starboard side of the channel.

San Francisco Bay, San Pablo Bay, and Napa Creek.

Sailing Directions.—From the anchorage off San Francisco, the course up the bay is N. W. by W., passing Angel Island as close as desired. There is deep water close to it. Continue this course, leaving the beacons on South Hampton Shoal a good berth to starboard, until Red Rock bears abeam; then change course to N. N. W., until San Pablo Point bears east, leaving the buoys on Whiting and Invincible Rocks well to the starboard; then steer N. N. E. ½ E. for 5 miles, when Pinole Point will bear S. by E. ½ E., distant 1 mile; thence N. E. ½ E. to entrance to Karquinez Straits.

Bound up Napa Creek.—Continue on a N. E. ½ E. course until the beacon on the shoal between Karquinez and Mare Island Straits bears N. E.; then steer for it until the Magazine wharf is well open around the southeast bluff of Mare Island; then turn (sharp if with the flood-tide, with easy helm if ebb-tide), and steer for the eastern end of Mill wharf, turning when in the center of the mouth of the strait, and steering to the northward and westward in mid-channel until abreast of western end of Railroad wharf; thence in mid-channel between the beacon on Commission Rock and the Mare Island shore. Continue in this mid-channel to anchorage off Navy Yard. At low water, vessels of over 18 feet draught should follow these directions closely.

Berkeley Reef—Pile beacon crowned with box, red and black horizontal stripes. West side of Brook's Island bears N. W. by W. ¼ W.; Alcatraz light S. W. ½ S. Beacon driven in seven feet of water, about 35 yards S. W. ⅜ W. of reef.

South Hampton Shoal, lower end—First-class nun buoy, in 14 feet water, red and black horizontal stripes. Northwest end of Angel Island S. W. ¾ W.; Point Richmond N. ¼ W.; Buoy on upper end of shoal, N. W. ¼ N. May be passed on either side by giving it a good berth. The shoal runs southeast and northwest 2⅛ miles.

South Hampton Shoal, upper end—First-class nun buoy, in 18 feet water, red and black horizontal stripes. Red Rock bears N. W. ¼ W.; south end of Angel Island, S. by E. ½ E.; Point Richmond, E. ¾ N. Should be given a wide berth in passing on either side.

Invincible Rock—Second-class can buoy, in 13 feet water, red and black horizontal stripes. Buoy on Whiting Rock bears N. ½ W.; Molate Point, E. by S. ½ S.; Point San Quentin, S. W. ½ W. Placed near the shoalest part of the rock, on which there is 8 feet at low water. It may be passed on either side, at a distance of fifty yards from the buoy.

Whiting Rock—Second-class can buoy in 18 feet water, red and black horizontal stripes. San Pedro Point bears N. N. W. ¾ W.; San Pablo Point N. E. ½ N.; Point San Quentin, S. W. There are 12 feet on the shoalest part of the rock at low water, and it can be passed safely on either side at a distance of fifty yards from the buoy.

East Brothers' Shoal—First-class can buoy, painted red, placed in 102 feet water.

San Pablo Point—Third-class nun buoy, No. 2, in 15 feet water, painted red. San Pablo Point bears S. ¾ E.; lighthouse on East Brothers S. by W. ¾ W. Placed just above San Pablo Point on the extreme edge of the bank, and must be left to starboard in going up the bay.

New Buoys—Black buoy No. 1 has been placed 2½ miles N., ⅜ W. from East Brother Island light, and 2.7 miles S. W. by W. ⅞ W. from Pinole Point.

Black buoy No. 3 has been placed 1½ miles N. N. W. ½ W. from Pinole Point, and 6 miles S. W. ⅝ W. from Mare Island light.

Black buoy No. 5 has been placed 3 miles S. W. by W. ⅛ W. from Mare Island light, and 2.8 miles N. W. by N. from Pinole Landing.

Pinole Point—Second-class nun buoy, No. 4, painted red, placed in 23 feet water. One-half mile off the Point, and should be left on starboard side in going towards Mare Island.

Shoal at Entrance to Mare Island Straits—Pile beacon crowned with box, in 20 feet of water, red and black horizontal stripes. Magazine Wharf bears N. W. ¾ N.; North head of Karquinez Straits, E. ¼ S. Placed on the northeast side of the channel, near the bank, in soft bottom, and at the turning point to Napa Creek, and must be left on the starboard side when going to Mare Island; port side, when going to Benicia.

Commission Rock—Second-class can buoy, in 15 feet water, painted red. Railroad Point bears N. E. by E. ⅜ E.; Magazine Point, S. E. ⅛ S. Is about fifty yards S. W. from the shoalest part of the rock, which is bare at low water, and must be left to starboard when going up the river.

Commission Rock Beacon—Cylindrical beacon of boiler iron, surmounted by a spindle and glass reflector, painted with red and white horizontal stripes. This beacon is built on the shoalest part of the rock. Care should be taken not to pass between it and the buoy.

Suisun Bay.

Sailing Directions—From Army Point steer N. E. by E. ¼ E., so as to pass midway between Seal Island and Buoy No. 3 (black), leaving the

buoy (with red and black horizontal stripes) on the end of the middle ground, and Buoys 1 and 3 a good berth on the port hand. When abreast of the upper end of Seal Island, change course to E. N. E. ½ E., and continue this course until Hastings' storehouse bears S. by W. ½ W.; then steer E. ¼ S., passing Middle Point close to. When Middle Point bears nearly astern, change course to E. N. E. ¼ E., and keep this course until Stake Point is abeam. From this point the course is in mid-channel, following the trend of the north shore to Beacon No. 8 (red). If bound up the Sacramento River, leave Tongue Shoal buoy close to on the starboard side. If bound up the San Joaquin, steer from Beacon No. 8 (red) to Beacon No. 10 (red) on the middle ground, leaving it on the starboard side. The lead should be kept going from time of entering Suison Bay until past Stake Point.

Third Class Nun Buoy—Red and black horizontal stripes. Point Edith bears E. N. E. ¾ E.; Suisun Point, S. S. W. ½ W. Placed in 19 feet water, muddy bottom. It must be left on the port side going up the Sacramento river. It is also at the turning point of Suisun Creek, and must be left on the starboard side by all vessels bound to that place.

Montezuma Creek—Third-class spar buoy, painted with red and black horizontal stripes, placed in 9 feet of water on a spit off Joyce's Island, at the intersection of Suisun and Montezuma Creeks.

No. 1—First-class spar buoy, in 19 feet water, painted black. Roe Island bears N. N. E ¾ E.; north end of Seal Island, N. E. by E. ¼ E.; Point Edith, S. W. ¼ W.; Hastings' storehouse, S. E. by E. ½ E. Placed in hard bottom. The channel here is very narrow. Must be left to port going up the bay.

No. 3—First-class spar buoy, in 20 feet water, painted black. Upper end of Seal Island bears E. ¾ S.; lower end of Seal Island S. ¾ E. Placed in soft, sticky bottom. Must be left to port going up the bay.

No. 4—First-class spar buoy, in 21 feet water, painted red. Lower end of Roe Island, W. N. W. ⅝ W.; north side Seal Island, S. W. ½ W. Placed in hard, sandy bottom. Must be left to starboard going up the bay.

Middle Point.—Single pile beacon crossed with boards, painted white. Gillespie's Point, W. N. W. ½ W.; Hastings' storehouse, S. W. ¾ S. Placed in 6 feet water, close to the Point, in soft, sticky bottom.

On Upper end of Middle Ground.—First-class spar buoy, red and black horizontal stripes. Stake Point, E. ⅞ S.; Snag Point, N. N. E. ⅞ E. In 21 feet water. There is a channel on either side of it.

No. 5—Pile beacon, crowned with box, in 10 feet water, painted black. Simmons' Point E. ¾ S.; buoy, upper end Middle Ground, S.

S. W. ¼ W. Placed near the middle of Honker Bay, and must be left to port going up the bay.

No. 6 Stake Point—First-class spar buoy, painted red. Beacon No. 5 bears N. W.; Middle Point, W. ⅞ S. Placed close to the Point, in 6 feet water; soft, sticky bottom.

Simmons' Point—Pile beacon, crossed with boards, painted white. Stake Point bears S. W. by W. ¾ W.; Beacon No. 5, W. N. W. ¾ W. Placed close to the Point, in 6 feet water; soft, sticky bottom.

No. 8—Pile beacon, crowned with box, in 9 feet water, painted red. Lower end of Chain Island, N. N. E. ¾ E.; right tangent of the San Joaquin River, E. ¼ N. Placed near the turning point to the San Joaquin.

No. 10—Pile beacon, crowned with box, in 4 feet water, painted red. Beacon No. 8, W. S. W. ⅛ W.; Collinsville wharf, over the center of Chain Island, N. W. ¼ N. Placed on the northwest end of Middle Ground, mouth of the San Joaquin River, and may be passed on either side by giving it a good berth.

No. 12, San Joaquin River—Three-pile beacon, crowned with box, painted red. Lower end of Chain Island bears N. N. E. ¾ E.; right tangent of San Joaquin E. ¼ N. Placed near the turning point to the San Joaquin.

N. W. end of Tongue Shoal, near the mouth of the Sacramento River. First-class spar buoy, painted red. Beacon No. 12 bears E. S. E. ¾ E.; Collinsville wharf, N. E. by E. Placed on the end of the shoal, in 20 feet water. Must be left to starboard, bound up the Sacramento River.

No. 14—Pile beacon, crowned with box, painted red. Beacon No. 12 bears W. S. W. ⅛ W.; Collinsville Wharf, over center of Chain Island, N. W. ⅛ N. Placed on northwest end of Middle Ground, mouth of the San Joaquin; may be passed on either side by giving it a good berth.

No. 7—Pile beacon crossed with boards, painted black. Placed on the end of spit above San Joaquin Middle Ground.

No. 16—Pile beacon, crossed with boards, painted red. Placed on south side of eastern entrance to New York Slough.

Through Petaluma Inlet to Petaluma Creek.

Sailing Directions—From East Brother Island the course is N. by W., to pass between Beacons No. 1 (black) and No. 2 (red); then N. W. ½ W. to Beacon No. 3 (black), leaving it close to on port hand;

from this point steer N. W. by W. to Beacon No. 5 (black), leaving it close to on port hand. Steer W. by N. $\frac{1}{4}$ N., from Beacon No. 5 to Beacon No. 4; thence in mid-channel up the creek.

No. 1—Pile beacon crowned with box, in 15 feet water, painted black. East Brother bears S. by E. $\frac{3}{8}$ E.; Petaluma Point, W. N. W. The best water is on the starboard side of the channel; must be left on the port side going in.

No. 2—Single pile, crossed with boards, in 9 feet water, painted red. Point San Pedro bears S. $\frac{1}{8}$ E.; Petaluma Point, W. N. W. $\frac{1}{4}$ W. To be left on the starboard side going in.

No. 3—Pile beacon crowned with box, in 9 feet water, painted black. Petaluma Point bears W. $\frac{5}{8}$ N.; Pinole Point, S. E. $\frac{3}{4}$ E. Placed in soft, muddy bottom.

No. 4—Pile beacon crowned with box, in 9 feet water, painted red. Petaluma Point, S. W. $\frac{3}{4}$ W.; Pinole Point S. E. by E. Placed in soft, muddy bottom.

No. 5—Pile beacon crowned with box, in 8 feet water, painted black. Point San Pedro bears S. by E. $\frac{3}{4}$ E.; Pinole Point, S. E. $\frac{3}{4}$ E. Placed in soft, muddy bottom.

Lower Part of San Francisco Bay and Entrance to Redwood Creek.

Sailing Directions—From Point Avisadera (Hunter's Point) steer S. E. $\frac{3}{4}$ S. until Point San Bruno is abeam, then S. E. by E., until Beacon No. 2 (red) bears abeam; then E. S. E. $\frac{1}{8}$ E to Beacon 6, leaving Beacons 4 and 6 on starboard side. When abreast Beacon 6, change course to pass between Beacons 6 and 1.

San Mateo, No. 2—Pile beacon crowned with box, in 10 feet water, painted red. Point San Mateo bears W. S. W. $\frac{3}{4}$ W.; Point San Bruno W. N. W.; Point Avisadera (Hunter's Point) N. W. $\frac{1}{8}$ N. Placed in soft, muddy bottom, on side of channel.

Redwood Creek, No. 4—Pile beacon crowned with box, in 8 feet water, painted red. Marsh Point bears S. E. $\frac{1}{8}$ S.; Potrero Point, E. S. E. $\frac{5}{8}$ E.; Beacon No. 1, S. E. $\frac{5}{8}$ S. Placed in soft, muddy bottom, on side of channel.

Redwood Creek, No. 6—Pile beacon crowned with box, in 7 feet water, painted red. Marsh Point bears S. by E. $\frac{3}{4}$ E.; Beacon No. 4, W. N. W. $\frac{1}{2}$ W. Placed in soft, muddy bottom.

Redwood Creek, No. 1—Pile beacon crowned with box, in 6 feet

water, painted black. Marsh Point bears S. $\frac{1}{2}$ E.; Beacon No. 4, N. W. $\frac{3}{8}$ N.; Beacon No. 6, N. N. W. $\frac{3}{4}$ W. Placed in soft, muddy bottom. To be left to port if bound into Redwood Creek, but well to starboard if bound to Point Potrero.

Coast North of San Francisco.

Blunt's Reef—Whistling buoy, painted with black and white perpendicular stripes. Cape Mendocino Lighthouse bears E. $\frac{3}{4}$ N., $3\frac{3}{4}$ miles; Outer Rock of reef E. by N., 1 mile. Placed in 150 feet of water, about a mile W. by S. of the outer rock.

Saunders' Reef Buoy—A whistling buoy, painted red and black horizontal stripes, will soon be placed off the western end of this reef.

Fort Bragg Buoy—A whistling buoy, painted in black and white vertical stripes, has been placed off the landing in $20\frac{1}{2}$ fathoms water, in range with black spar buoy on end of reef (on north side of entrance), and the wharf at Fort Bragg.

Entering Humboldt Bay, to Eureka and South Bay.

Sailing Directions.—There are usually about 12 feet at low water on this bar. As the bar is constantly changing, no sailing directions can be given. The locality may be easily recognized by a remarkable red bluff facing the entrance, and by a first-class whistling buoy just outside the bar, W. $\frac{1}{4}$ S., 1 9-10 miles from Humboldt Lighthouse. A stranger should not, under any circumstances, attempt to cross the bar without pilot. There are several powerful tugs here, under charge of skillful pilots, who take vessels in. The mid-channel buoy is not to be depended upon, as the bar constantly shifts.

Outside Bar Buoy—Whistling buoy, black and white perpendicular stripes. This buoy has been removed to a position $1\frac{3}{8}$ miles W. S. W $\frac{3}{8}$ W. from Humboldt Light. The whistle is sounded by the action of the sea, and gives from 20 to 30 blasts a minute.

A black buoy No. 1 has been placed on the north side of the channel, about 1 mile S. by E. $\frac{7}{8}$ E. from Humboldt Light, and a black buoy No. 3, $\frac{3}{4}$ mile S. E. $\frac{7}{8}$ S. from the same light.

Mid-Channel Buoy—Second-class can buoy, black and white perpendicular stripes. The buoy is just outside the breakers, in 48 feet of water. Owing to the frequent changes of the bar, no bearings can be given for this buoy.

Howard Spit Buoy—Third class nun buoy, red and white horizontal stripes. Red Bluff bears S. E. $\frac{1}{4}$ S.; Humboldt lighthouse, N. N. W.;

Buoy, lower end of middle ground, in South Bay, S. by W. ½ W. Placed in 13 feet water, on the western extremity of Howard Spit, in hard, sandy bottom. Must be left on the starboard side by vessels bound to Eureka. It is also at the turning point to South Bay.

Humboldt Bay Buoy, No. 2—Third-class can buoy, painted red. Placed in 12 feet water, hard, sandy bottom, and must be left to starboard by vessels bound to Eureka.

Buoy No. 1—Third-class nun buoy, painted black; is placed in 14 feet water, hard, sandy bottom.

Buoy No. 3—Third-class nun buoy, painted black; is placed in 15 feet water, hard, sandy bottom.

Buoy No. 4—Third-class can buoy, painted red; is placed in 18 feet water, hard, sandy bottom.

No bearings that will be permanent can be given for the above four buoys, owing to frequent changes in the channel.

A single pile beacon, painted red and numbered 2, has been placed on the right hand side of the Hookton channel, about half way from Point Humboldt to the wharf at Fields' Landing, to mark a sharp turn in the channel.

A single pile beacon, painted red and numbered 6, has been placed on the end of a shoal, off Clark's Slough.

A single pile beacon, painted red and black, has been placed between the City wharf and Indian Island, to mark the end of the shoal ground at the junction of Eureka slough and the channel from upper bay, on S. E. side of Indian Island.

The channel to Arcata, on the N. W. side of Indian Island, has been marked by six beacons; three painted red, and numbered 8, 10 and 12; three painted black, and numbered 5, 7 and 9. In proceeding to Arcata the black beacons with odd numbers must be left on the port hand, and the red beacons with even numbers on the starboard hand.

All the beacons are placed in shoal water, and must be given a good berth in passing them.

Indian Island Spit Buoy—Third class nun buoy, red and black horizontal stripes. Saw-mill Wharf bears N. E. by E. ¼ E.; extreme point of Indian Island, N. by E. ¾ E.; Flannigan's Wharf, S. Placed in 10 feet water, hard sandy bottom, on the south end of the spit, and must be left on the port side by vessels bound to Eureka, and on the starboard side when bound up to North Bay.

Lower end of Middle Ground, South Bay Buoy—Third-class nun buoy, red and black horizontal stripes. Red Bluff bears N. E. ¼ N.; Howard Spit buoy, N. by E. ¼ E.; Humboldt Lighthouse, N. ⅞ W.

Placed in 10 feet water, hard sandy bottom, and in passing should be given a good berth.

Entering Crescent City Harbor.

Sailing Directions—When within 50 yards of Round Rock, on either side, steer from it N. by W. for Fauntleroy Rock and spar buoy; leave this buoy close aboard on port hand, as about 500 feet to starboard there is another rock, with but two feet of water on it. The course is between those rocks. After passing Fauntleroy Rock, round up gradually with starboard helm for the wharf, and anchor in 3½ fathoms water. This harbor is a fair summer anchorage, but a very exposed and dangerous one in winter. At low tide the remains of a spindle may be seen on Fauntleroy Rock. At high tide the rock is covered.

First-class Spar Buoy.—Painted with red and black horizontal stripes. Fauntleroy Rock bears W. 50 feet distant. Placed in 26 feet water. In entering, vessels must leave this buoy close to on the port side.

To mark Koos Bay and the Channel across the Bar to Empire City.

NOTE.—The entrance to this channel undergoes frequent and irregular changes in depth and direction. The change of the tide often suddenly produces a corresponding change in the direction of the channel, therefore, no course that may be given to cross the bar can be relied upon for any length of time.

Outside Bar Buoy—Whistling buoy, painted with black and white perpendicular stripes. Cape Arago (Gregory) lighthouse bears S. ½ E.; Koos Head, S. E. by E. ½ E.; bar buoy, S. E. by E. ¼ E. Placed about 1¼ miles outside of the bar, in 78 feet of water. It is surmounted by a whistle, sounded by the action of the sea, giving 20 to 30 blasts per minute.

On the Bar Buoy—Second class can buoy painted with black and white perpendicular stripes. Guano Rock E. S. E. ¼ E.; Koos Head bears S. E. by E. ½ E.; Cape Arago Lighthouse S. W. ½ S.; End of breakwater E. N. E. ¾ E. Placed on the bar in 14 feet water, and may be passed close to on either hand.

Sand Spit, west of Fearless Rock—First-class spar buoy No. 1, painted black. Koos Head bears S. W. ¼ S.; Fossil Point E. by S.; Pigeon Point E. N. E. ¾ E; Buoy No. 4 N. Placed in 8 feet water, close to sand, which is bare at low water.

A new black buoy has been placed 525 yards W. S. W. ½ W. from Fossil Point. Red buoy No. 2 has been changed to a position 275 yards W. N. W. ⅝ W. from Fossil Point, and red buoy No. 4 to a position 675 yards N. N. W. ½ W. from Pigeon Point.

Red Buoy No. 6 has been moved about 1¼ miles down the bay, and is now just to the westward of the three foot rock which lies 3-10 miles N. ¾ W. from the upper pier, Empire City.

Red Buoy No. 8 now lies about 175 yards S. W. by W. from the old position of red buoy No. 6.

A red buoy No. 10 has been placed 1,050 yards W. ¾ N. from North Bend Point.

Port Side of Channel—First-class spar buoy No. 3, painted black. Placed in 8 feet water. North Bend Point bears S. E.; Russell Point N. by W.; Poney Point S. W. Give this buoy a berth of 300 feet

Port Side of the Channel—First-class spar buoy, No. 5. painted black. Marshfield Point bears S. E. ½ S.; Cooper Point N. N. W.; Pierce's Point, N. N. E. ¼ E. Give this buoy a berth of 200 feet.

Entrance to Umpqua River.

Ouside Bar—Second-class can buoy, painted with black and white perpendicular stripes. North Sands bear N. E. ⅞ N.; Eastern Head, Winchester Bay, N. E. ⅛N.; West side Winchester Bay, N. E. ⅞ E. Placed in 60 feet water, W. S. W. from the entrance to the river.

Entrance to Alseya River.

NOTE.—*There are seven feet at low water.*

Alseya River—First-class can buoy, painted with black and white perpendicular stripes. Placed in 66 feet water, S. W. by W. from the entrance to the river.

To mark Yaquina Bay and the Channel to Upper End of Middle Ground.

NOTE.—Vessels should not enter without a pilot who has a thorough knowledge of the hidden dangers.

The whistling buoy now lies 2.3 miles S. W. ¾ W. from Beacon C and black buoy No. 1, about 1½ miles S. W. ¾ W. from the same beacon. Red buoy No. 2 has been moved to a position 1,090 yards N. ⅜ W. from Beacon B.

A day beacon has been placed on the outer end of the jetty.

Outside Bar Buoy No. 1—First-class can buoy, painted black. Cape Foulweather Lighthouse bears N. by W. ¼ W.; light beacon (light discontinued), N. E. ½ N.; End of Jetty N.E. by E. ½ E. Placed in 53 feet water, about one-fourth of a mile southwest of the end of the reef, in hard, sandy bottom.

Beacon "A."—Pyramid, painted white, surmounted by a flag-staff. Beacon B bears W. S. W. ⅛ W.; End of Jetty S. W. by W.; Beacon C, S. W. ⅝ S. Forms a range with Beacons B and C, to show the position of submerged rocks on the north and south sides of the channel.

Beacon "B."—Pyramid painted white. Beacon A bears E. N. E. ⅛ E.; Yaquina Lighthouse, N. W. ⅝ W. Forms a range with Beacon A, to mark submerged rocks on the north side of channel.

Beacon "C."—Pyramid painted white. Beacon A bears N. E. ⅝ N.; Yaquina Lighthouse, N. W. ½ N. Forms a range with Beacon A to mark submerged rocks on the south side of channel.

On Starboard side of Channel, opposite Newport.—Third-class nun buoy, No. 2, painted red. Flag Staff bears S. S. E. ½ E.; Point Virtue, E. S. E. ¾ E; Beacon B, S. ⅝ E. Placed in 20 feet water, near sand bank, on the Starboard side of the channel.

Northeast end of Sands—First class spar buoy, No 4, painted red. Point Virtue bears S. E. by E.; Flag Staff S. ½ E. Placed in 19 feet water, and marks the turn in the channel above Newport.

East side Middle Sands—Third-class nun buoy, No. 6, painted red, placed in 15 feet water. Point Virtue bears S. E. ½ E.; Flag Staff, S. ⅝ W.

Flats below Coquille Point—First-class spar buoy, No. 3, painted black, placed in 10 feet water. Yaquina old lighthouse bears W.; Point Virtue S. W. by W.

To mark Tillamook Bay.

NOTE.—*There are 7 feet at low water on this bar.*

Tillamook Bar Buoy—Second-class can buoy, black and white perpendicular stripes. Double-headed Rock, N. ¼ W.; House and Fuller's Rock, in range E. N. E. ½ E. Placed outside the bar in 22 feet water.

North Spit—Third-class nun buoy, No. 1, painted black, placed in 28 feet water. Fuller's Rock bears E. N. E. ¾ E.; Sandstone Point, S. E. by E. ¾ E.

South Spit—Third-class nun buoy, No. 2, painted red; placed in 27 feet water. Fuller's Rock bears N. E.; Sandstone Point, E. S. E.

On Rocks off Bailey's Point—Third-class nun buoy, red and black horizontal stripes. Green Hill bears N. W. ¼ W.; Bailey's Point, N. E. ¾ E.; Mameluet Head, E. ¾ S. Placed in 12 feet water, just west of Bailey's Point. Should be left on the starboard hand going in.

South Channel Entrance to Columbia River, as far as Astoria.

NOTE.—*There are 20 feet at low water in this channel on the bar.*

Directions for Crossing the Bar—If from the southward, bring Cape Disappointment lighthouse to bear N. ¾ W., and steer for it until Point Adams lighthouse bears N. E. ⅜ E. You will then be at the whistling buoy, in 18 fathoms water. If from the northward, when Cape Disappointment lighthouse bears E. N. E., distant five miles, steer S. E. until at the whistling buoy. From this buoy steer N. ¾ W. for 3⅞ miles, for Cape Disappointment lighthouse, passing the channel buoys close to on either hand. When up to the middle channel buoy, in 5 fathoms of water, steer N. E. ⅞ N. for 1 mile, when you will be up to buoy No. 2, which may be passed close to. From buoy No. 2 head for the beacon on Sand Island, N. E. ½ N., 1⅜ miles, until between buoy No. 4 and the black bell buoy off wreck of the Republic; then steer E. by N. 1 mile, when you will be between Sand Island beacon and buoy No. 6. From here steer S. E. by E. ½ E, 3 miles, passing buoy No. 5, and you will be abreast Fort Stevens wharf, where there is a white stake-light. From Fort Stevens wharf steer E. ¾ S., 1⅜ miles, to buoy No. 7; then E. ¼ N., 1¾ miles, to buoy No. 9; and then N. E. by E. ½ E., 1⅛ miles, to buoy No. 11 and Astoria, passing a fixed red stake-light on Smith's Point wharf. In following the above directions, the current should be carefully observed and allowed for. It sometimes attains a velocity of 3 or 4 knots. Directions for crossing the bar cannot be relied on for any length of time, as changes in depth and direction of the channel are constantly going on.

Outside Bar Buoy—First-class whistling buoy, black and white perpendicular stripes. Point Adams lighthouse bears N. E. ⅜ E.; Cape Disappointment lighthouse N. ¾ W., 6¾ miles; sea buoy, N. ¾ W., 1⅛ miles; Tillamook rock lighthouse, S. E. by S., 13⅝ miles. Placed in 108 feet water, outside the bar of the Columbia river, south channel; may be passed close to on either hand. The whistle is sounded by the action of the sea, giving from 20 to 30 blasts a minute.

Sea Buoy—First-class can buoy, black and white perpendicular stripes. Point Adams lighthouse bears N. E. by E. ½ E.; Cape Disappointment lighthouse, N. ¾ W.; Fairway Buoy, N. ¾ W. ¾ of a mile. Placed in 75 feet water.

Fairway Buoy—First-class nun buoy, black and white perpendicular stripes. Point Adams lighthouse bears E. N. E. ¼ E.; Cape Disappointment lighthouse, N. ¾ W.; Bar buoy N. by W. ⅛ W., seven-eighths of a mile; Sand Island beacon, N. by E. ¾ E. Placed in 38 feet water outside and close to the bar. The sea does not break at this buoy in good weather.

Bar Buoy—First-class nun buoy, black and white perpendicular stripes. Cape Disappointment lighthouse bears N. ⅝ W.; Point Adams lighthouse, E. ½ N.; Sand Island beacon, N. N. E. ½ E.; Mid-channel buoy, N. ⅞ W., 1 mile.

Mid-Channel—First-class can buoy, black and white perpendicular stripes. Point Adams lighthouse, E. ⅝ S.; Sand Island beacon, N. E. ⅝ N.; Cape Disappointment lighthouse, N. ½ W.; Bell buoy, N. N. E. ¾ E., 2½ miles. Placed inside the bar, in 30 feet water.

Bell Buoy—Painted black, moored in 30 feet water, about ½ mile S. ¼ E. of the wreck of the "Great Republic," off Sand Island. The bell is rung by the action of the sea.

Clatsop Spit—First-class nun buoy, No. 2, painted red. Cape Disappointment lighthouse bears N. N. W. ⅛ W.; Point Adams lighthouse E. S. E. ⅜ E.; Sand Island beacon N. E. ¾ N.; Buoy No. 4, N. E. 1⅜ miles. Placed on the southwest side of the spit, in 23 feet water.

Clatsop Spit—First-class nun buoy, No. 4, painted red. Cape Disappointment lighthouse bears N. W. by W. ⅛ W.; Range-beacon, Sand Island, N. N. E. ½ E. Placed in 24 feet water.

Sand Island Beacon—Pyramid, painted white, fifty feet high, placed on the eastern point of Sand Island, 1 mile E. N. E. ½ E. of the wreck of the "Great Republic."

Clatsop Spit—First-class can buoy, No. 6, painted red. Cape Disappointment lighthouse bears W. N. W.; Buoy No. 5, E. S. E. ⅝ E., 2⅛ miles; Sand Island beacon N. N. W.; Point Adams lighthouse S. E. ½ S.; placed in 39 feet water. After passing this buoy, observe to keep the perpendicular face of Cape Disappointment projected against the low-sloping base of McKenzie's Head, which insures clearing the lower end of the Middle Ground, and is an excellent guide for passing through this stretch of the river.

New Buoys—Two new buoys, first-class can buoys, numbered 1 and 1½, painted black, have been moored on Columbia River bar, to mark the channel over the middle sands. There are from 16 to 18 feet at low water over the sands. This channel should not be attempted by strangers.

Buoy No. 1 is in 8 fathoms water outside the bar. From this buoy

Point Adams lighthouse bears E. ¼ N.; Cape Disappointment lighthouse N. by E. ⅝ E., and the inner mid-channel buoy N. E. by E. ⅛ E.; distant 1¾ miles.

Buoy 1½ is in 25 feet water, inside the bar. From this buoy, Point Adams lighthouse bears E. ⅜ S.; Cape Disappointment lighthouse N. ¾ E.; and the inner mid-channel buoy N. E. by E. ⅛ E., distant ¾ mile.

Both these buoys should be left to the northward, and may be passed close to.

Lower End of Middle Ground—First-class can buoy, No. 5, painted black. Cape Disappointment lighthouse W. N. W. ¼ W.; Point Ellice N. E. ¼ E; Buoy No. 7, E. S. E. ½ E., 2½ miles. Placed in 19 feet water, and marks the lower end of the Middle Ground, and care should be taken, after passing it, not to approach too closely the line of buoys, as the edge of the Middle Ground is abrupt, and partially bare at low water.

Fort Stevens Wharf Stake Light—White stake on end of wharf, with a box on top for a lantern. A white light is shown from a river lantern at night.

South Side of Middle Ground—First-class spar buoy, No. 7, painted black. Tansy Point bears S. by E. ½ E.; Sand Island beacon, N. W. by W. ¾ W.; Buoy No. 9, E. ¼ N. Placed in 18 feet water, and marks the south side Middle Ground.

South Side of Middle Ground—First-class spar buoy, No. 9, painted black. Tansy Point bears S. W. by W. ¼ W.; Buoy No. 11, N. E. by E. ⅝ E.; Smith's Point stake light, E. by S. Placed in 21 feet water.

Smith's Point Stake Light—A fixed red light, on a white stake on the end of wharf, half a mile below Astoria.

South Side of Middle Ground—First-class spar buoy, No. 11, painted black. Smith's Point bears S. S. W. ¼ W.; Cliff Point, N. by W. ¾ W.; Fort Stevens Wharf, W. by S. Placed in 21 feet water. Vessels should anchor between this buoy and Buoy No. 13, in mid-channel, off Astoria.

South Side of Middle Ground—First-class spar buoy, No. 13, painted black. Fort Stevens wharf bears W. S. W. ¾ W.; Cliff Point, N. N. W. ½ W. Placed in 22 feet water.

The North Channel Entrance to Columbia River, as far as Astoria.

NOTE.—*This channel has changed within the last year and is very little used at present.*

Peacock Spit—First-class nun buoy, No. 1, painted black. Cape Disappointment lighthouse bears N. by E.; Point Adams lighthouse E. S. E. $\frac{1}{4}$ E. Placed in 24 feet water, and marks the spit extending from Cape Disappointment.

Peacock Spit (southeast end)—First-class nun buoy, No. 3, painted black. Cape Disappointment lighthouse N. W. $\frac{1}{4}$ N.; Beacon, Sand Island, N. E. by E. $\frac{3}{4}$ E. Placed in 24 feet water, on the southeast extremity of Peacock Spit.

Clatsop Spit—First-class nun buoy, No. 4, painted red. Point Adams lighthouse bears S. E. $\frac{3}{4}$ E.; Beacon, Sand Island, N. N. E. $\frac{1}{2}$ E. From this buoy follow directions for South Channel.

Columbia River, Entrance to Baker's Bay, and Channel North of Sand Island.

NOTE.—*There are 8 feet of water into Baker's Bay. The channel between Cape Disappointment and Sand Island is closed at present.*

Sand Island, northwest part—40-foot spar buoy, No. 4, painted red. Cape Disappointment lighthouse bears S. W. $\frac{1}{2}$ W.; Beacon on Sand Island, S. E. by E. $\frac{1}{4}$ E.

Chinook Spit, upper end—40-foot spar buoy, No. 7, painted black. Cape Disappointment Lighthouse bears S. W. $\frac{3}{4}$ W.; Beacon on Sand Island, S. E. $\frac{1}{2}$ S.

Mid-channel—First-class spar buoy, black and white perpendicular stripes. Beacon on Sand Island bears W. by S.; Point Adams S. by E. $\frac{3}{4}$ E.; Buoy No. 5, S. E. $\frac{1}{2}$ S. Placed in 10 feet water, and should be left on the port hand fully $\frac{1}{4}$ of a mile. From this buoy, if bound for Astoria, steer S. E. $\frac{3}{4}$ S., and proceed as in the South Channel.

Columbia River.

CHANNEL TO CEMENTVILLE, AND TO MAIN SHIP-CHANNEL.

First Buoy—Forty-foot spar buoy, No. 1, painted black. Point Ellice bears S. W. $\frac{3}{4}$ S; Smith's Point, S. $\frac{1}{4}$ E.; Cliff Point, S. W. $\frac{3}{4}$ W. Placed in 14 feet water.

Second Buoy—Forty-foot spar buoy, No. 3, painted black. Tongue Point bears S. S. E. ¼ E.; Gray's Point, N. W. by W. ⅝ W. Placed in 16 feet water. Hard, sandy bottom.

Third Buoy—Forty-foot spar buoy, No. 5, painted black. Tongue Point bears S. by E. ¾ E.; Gray's Point, W. ½ N. Placed in 16 feet water.

Fourth Buoy—Forty-foot spar buoy, No. 2, painted red. West side of Tongue Point bears S. ⅛ E.; Gray's Point, W. S. W. ½ W. Placed in 18 feet water. Hard, sandy bottom.

Fifth Buoy—Forty-foot spar buoy, No. 4, painted red. Gray's Point bears W. ½ S.; Tongue Point, S. ¾ W. Placed in fifteen feet water. Hard, sandy bottom.

Sixth Buoy—Forty-foot spar buoy, No. 7, painted black. Tongue Point bears S. by W. ½ W.; Gray's Point, W. ¼ S. Placed in 15 feet water.

Seventh Buoy—Forty-foot spar buoy, No. 9, painted black. Tongue Point bears S. S. W. ½ W.; Gray's Point, W. ¼ S.

Columbia River, to mark the Main Ship-Channel

FROM ASTORIA TO TONGUE POINT.

Gilman's Ledge—Third-class nun buoy, No. 2, painted red. Catholic Church bears S. S W.; Chinook Point, W. N. W. ½ W.; Buoy No. 4, N. E. ¾ E. Placed in 14 feet water, 50 yards northwest of the ledge. Vessels drawing less than 10 feet may pass over it at any time.

Middle Ground, South Side—First-class spar buoy, No. 1, painted black. Cliff Point bears N. W. ½ N.; Buoy No. 2, S. S. W. ¼ W.; Astoria wharves, S. W. ¾ W. Placed in 20 feet water.

Wreck of "Silva de Grace"—First-class nun buoy, No. 4, painted red. Tongue Point, N. E. ⅜ N.; Portuguese Point, N. ½ W. Placed 50 feet N. W. by N. from the wreck, in 27 feet water.

Middle Ground, South Side—First-class spar buoy, No. 3, painted black. Tongue Point N. N. E. ⅜ E.; Portuguese Point, N. ⅝ W. Placed in 12 feet water, sandy bottom.

Flats South Side of Channel—First-class spar buoy, No. 6, painted red. Tongue Point, N. N. E.; Portuguese Point, N. by W. Placed in 16 feet water.

Tongue Point—A fixed white light, about a third of a mile from the extreme end of the point.

Shoalwater Bay Channel across the Bar, and up the Wallapah River.

NOTE.—*There are* 16 *feet at low water in this channel across the Bar.*

Sailing Directions—Bring Toke Point Lighthouse to bear N. ⅜ E., and steer for it. When the northern trees on Leadbetter Point bear E. by N., you will be up with the outside Bar buoy. Continue on this course, passing the inner Bar buoy, and leave the Black buoy, No. 1, on the south end of Toke Point Spit, 100 yards on the port hand; then change course to N. N. E. for Buoy No. 4, leave it 100 yards on the starboard hand, and change course to N. E. by E. for the Wallapah. Strangers should not attempt to enter this bay without a pilot. In using these courses, observe the set and velocity of the current. At certain stages of the tide, the current runs with great rapidity.

Outside Bar—First-class nun buoy, black and white perpendicular stripes. Toke Point Lighthouse bears N. ⅜ E.; Leadbetter Point, E. by N.; Bar buoy, N. ½ E. Placed in 50 feet water; may be passed on either hand.

Bar Buoy—Second-class can buoy, black and white perpendicular stripes. Toke Point Lighthouse bears N. ½ E.; Leadbetter Point, E. by S.; Buoy No. 1, N. E. by E. Placed in 18 feet water; may be passed on either hand.

Toke Point Spit, south end—First-class nun buoy, No. 1, painted black. Toke Point Lighthouse bears N.; Leadbetter Point, E. S. E. ¾ E.; No. 4 buoy, N. N. E. Placed in 30 feet water.

Sand Island, north end—Second-class nun buoy, No. 4, painted red. Toke Point Lighthouse, N. N. W.; Buoy No. 3, N. N. E. ½ E. Placed in 26 feet water.

Sand Island, N. E. end—Second-class nun buoy, No. 6, painted red. Goose Point bears E. S. E. ½ E.; Toke Point Lighthouse, N. W. by W. ¼ W.; Buoy No. 8, N. E. ¾ N. Placed in 15 feet water. Hard, sandy bottom. This is a very dangerous shoal, with rapid and treacherous currents. Sailing vessels should not approach this buoy within a cable's length.

Jenny Ford Spit—Third-class nun buoy, No. 3, painted black. Toke Point Lighthouse bears W. N. W.; Range Point, N. E. by E. ½ E.; Buoy No. 1, (Lighthouse Cove) N. by W. ¼ W. Placed in 22 feet water, at the junction of the Wallapah and the Channel to the Lighthouse Cove.

Lower end of Middle Ground, Wallapah River—Second-class nun

buoy, No. 8, painted red. Goose Point bears S. E. by E.; Buoy No. 10, N. E. by E. ¼ E.; Toke Point Lighthouse, W. N. W. ½ W. Placed in 18 feet water, off Goose Point.

Upper end of Middle Ground, Wallapah River—Second-class nun buoy, No. 10, painted red. Toke Point Lighthouse bears W.; Goose Point, S. S. E. ¾ E.; Buoy No. 5, N. E. ¾ E. Placed in fifteen feet water, and should be given a berth of 100 yards in passing.

Wallapah River—Third-class nun buoy, No. 5, painted black. Range Point bears N. E. by E. ¾ E.; Stony Point S. E. ¾ S.; Second Beacon, N. E. by E. ½ E. Placed in 18 feet water. Hard, sandy bottom.

Shoalwater Bay—Entering Lighthouse Cove.

Jenny Ford Spit—Third-class can buoy, No. 3, painted black. Lighthouse bears W. N. W.; Range Point, N. E. by E. ½ E.; Lighthouse Cove Buoy, N. by W. ¼ W. Placed in 22 feet water. When up to this buoy, leave it on the starboard side, and keep close to the sands on the port side until up to Spar Buoy No. 1, where make a sharp turn to the westward close to Buoy No. 1, and head for the lighthouse. There is good anchorage in 3½ fathoms when nearly up to the life-saving station. If bound up to the Wallapah River, this buoy must be left on the port hand.

Lighthouse Cove—Third-class spar buoy, No. 1, painted black. Low point to the eastward bears E. ½ N.; Lighthouse, W.; Buoy No. 3, S. by E. ¼ E. Placed in 11 feet water at a sharp turn in the channel 25 yards from the low water end of the spit, and should be passed close to, as the channel is only about 50 yards wide.

Shoalwater Bay.—To mark the Oysterville Channel.

No. 1—Third-class nun buoy, painted black. Goose Point bears E. ¾ N.; west side Long Island, S. by E. ¾ E. Placed in 11 feet water, hard, sandy bottom. This buoy is a guide for vessels bound up the slough.

Lower end of Riddle Spit—Third-class nun buoy, red and black horizontal stripes. Goose Point bears N. E. by N.; west side Long Island. S. S. E.; Leadbetter Point, S. W. ¾ W. Placed in 14 feet water, and marks the junction of Nemah and Oysterville Channels. Care should be taken to give it a good berth.

No. 3—Third-class nun buoy, painted black. Goose Point bears N. ¼ W.; Leadbetter Point, W. ½ S.; Buoy No. 2, S. S. E. ¼ E. Placed in 21 feet water, hard, sandy bottom.

No. 2—Third-class can buoy, painted red. Leadbetter Point bears W. N. W.; Goose Point, N. by W. Placed in 17 feet water, hard, sandy bottom, near sand flats, partially bare at low water.

No. 4—Third-class nun buoy, painted red. Goose Point bears N. by W. ¼ W.; Oysterville wharf S. W.; Buoy No. 5, S. E. by E. ¾ E. Placed in 18 feet water, hard, sandy bottom.

No. 5—Third-class nun buoy, painted black. West side Long Island bears S. ½ E.; Goose Point, N. by W. ¾ W. Placed in 12 feet water, hard, sandy bottom, close to steep bank.

No. 6—Third-class nun buoy, painted red. Oysterville Wharf bears S. W. by W. ½ W.; west side Long Island, S. by E. ¼ E. Placed in 14 feet water, hard, sandy bottom.

No 7.—Third-class nun buoy, painted black. West side Long Island bears S. ½ E.; Oysterville wharf, W. ½ S. Placed in 16 feet water.

Entrance to Gray's Harbor.

NOTE.—*There are* 12 *feet at low water on the bar.*

Sailing Directions—Bring the house on the end of Point Hanson to bear N. E. by E. ½ E., and steer for it until the solitary spruce tree on Point Brown bears N. N. E., when you should be up with the Outer Bar buoy, in 8 fathoms water. Pass close to on either side, and steer N. E. ½ E. 1 mile, for Inner Bar buoy. From the Inner Bar buoy, which is in 28 feet water, steer N. E. ½ E., 3¾ miles, passing Buoy No. 1, and pass close to the beach of Point Hanson; then steer N. N. E., for Buoy No. 2, on the west side of Whitcomb Flats.

Outside Bar—First-class nun buoy, black and white perpendicular stripes. Solitary spruce tree on Point Brown bears N. N. E ; House on Point Hanson, N. E. by E. ½ E.; Inner Bar buoy, N. E. ½ E. Placed in 48 feet water. Steer N. E. ½ E., 1 mile, for Inner Bar buoy.

Whistling Buoy—A red whistling buoy has been placed in about 12 fathoms water off the entrance to Gray's Harbor. This buoy lies 4¼ miles S. W. ¾ W. from the northern extremity of Point Chehalis.

Inner Bar—Second-class nun buoy, black and white perpendicular stripes. Solitary spruce tree on Point Brown, N. by E. ½ E.; house on Point Hanson, N. E. by E. ¾ E.; Buoy No. 1, N. E. by N. Placed in 28 feet water. From this buoy steer N. E. ½ E., 3 miles, passing close to Point Hanson.

North Breakers—Second-class nun buoy, No. 1, painted black. Solitary spruce tree on Point Brown, N. ½ E.; house on Point Hanson, E.

½ N. Placed in 34 feet water, close to the breakers on the north side of the channel, in hard, sandy bottom.

Whitcomb Flats—Third-class nun buoy, No. 4, painted red. Solitary spruce tree on Point Brown, W. N. W. ¼ W.; House on Point Hanson, S.; Ned's Rock N. by E. ¼ E. Placed in 13 feet water.

Gray's Harbor. North Channel to Hoquiam.

Sailing Directions—When Buoy No. 2 bears S. E. by S. ¼ of a mile, steer N. E. by E. for 3⅝ miles, leaving Beacon 1200 yards on port hand, and Beacon 2 ⅜ of a mile on port hand. When Beacon 2 bears W. by N., change course to N. E. by N., and run two miles, leaving Beacon 3, 300 yards on starboard hand. When Beacon 3 bears south, steer N. E. by E. 1 mile, and then E. N. E. ⅜ of a mile, when you will be up to Beacon 4. Leave Beacon 4, 50 yards on starboard hand, and keep between the snags on the port side and middle ground on starboard side, until you open the town of Hoquiam, and then steer for it.

Beacon No. 1—Single pile, four boards nailed across on top, painted black. Ned's Rock bears N. by W. ½ W.; Lone tree on Point Brown, W. S. W. ⅛ W.; Beacon 2, N. E. ½ N. Placed in 5 feet water. To be left 200 yards on port hand.

Beacon No. 2—Single pile, four boards nailed across on top, painted black. Lone tree on Point Brown bears W. S. W. ⅜ W.; Beacon 3, N. E. ¼ E. Placed in 7 feet of water. To be left ⅜ of a mile on port hand.

Beacon No. 3—Single pile, four boards nailed across on top, painted red. Stearns' Bluff bears S. ¼ W.; Ned's Rock, W. N. W. ¾ W.; Beacon 4, N. E. ¼ E. Placed in 6 feet water. To be left 300 yards on starboard hand.

Beacon No. 4—Single pile, four boards nailed across on top, painted red. Saw-mill bears N. E.; Stearns' Bluff, S. by W. ¾ W. To be left 50 yards on starboard hand.

To mark New Dungeness and Partridge Bank.

Crescent Bay—Second-class nun buoy, No. 2, painted red. Tongue Point bears E. ¾ N; west side of Crescent Bay, S. by E. ¼ E.; three-eighths of a mile. Placed in 24 feet of water, 50 yards N. by W. of a rock with 3 feet on it at low water. The reef extends about one-eighth of a mile to eastward, and one-half mile to westward of the buoy. There is a channel inside the reef, close to the shore.

Sand Spit, New Dungeness—First-class nun buoy, No. 2, painted red. New Dungeness Lighthouse bears S. by W. ¾ W.; southwest end Protection Island, E. by S.; Kula Kula Point, S. E. ¾ S. Placed in 27 feet water, hard, sandy bottom, and marks the end of the spit, which extends about one mile from the lighthouse. It must be left to starboard by vessels entering Dungeness Roadstead, or bound up the Straits.

Protection Island, Southwest Spit—First-class can buoy, No. 1, painted black. Dungeness Lighthouse bears W. ¾ N.; southwest end of Protection Island, E. N. E. ¼ E.; Chatam Point, E. S. E. ¾ E. Placed in 33 feet water, about one half mile from end of spit which makes out from southwest end of Protection Island. Leave the buoy on the port hand in coming in from the westward and passing to southward of Protection Island.

Point Middle—Third-class nun buoy, red and black horizontal stripes. New Dungeness Lighthouse, W. ¾ S.; Point Partridge, N. ½ W. Placed in 15 feet water, one half mile N. E. by N. of Point Middle, outside and close to a small sunken rock which is awash only at lowest tides. Give this buoy a berth of 300 feet.

Partridge Bank, Whidby Island, Fuca Strait—First-class nun buoy, No. 1, painted black. Smith's Island Lighthouse bears N. 25° 23′ W.; Dungeness Lighthouse, S. 45° 07′ W.; Admiralty Head Lighthouse, E. 19° 35′ S. This buoy has been moved 200 yards to the northward and westward outside of the kelp.

Point Partridge—Second-class nun buoy, No. 2, painted red. Smith's Island Lighthouse bears N. W. ¼ W.; Admiralty Head Lighthouse, S. E. by E. ¾ E.; Partridge Bank buoy, W. N. W. ¼ W. Placed in 31 feet water, about one fourth mile of Point Partridge, just outside the kelp.

Minor Island—A white tripod 35 feet high, with boards on upper half. Smith's Island Lighthouse bears S. W. 1⅛ miles. Placed near high water mark, on the east end of the sand-spit that makes out from Smith's Island.

Nee-ah Bay Buoy—A whistling buoy painted red, with the letters N B in white, is moored in about 22 fathoms water about ¼ mile from Wa-addah Island, entrance to Nee-ah Bay. N. E. end of Wa-addah Island bears S. E., distant ⅝ mile; Koit-lah Point S. W. by W., distant 1¼ miles; Cape Flattery Lighthouse, W. S. W. distant 5⅛ miles.

Oak Harbor—The buoy off Forbes Point entrance has been moved 200 yards to the southward. A black spar buoy has been placed on the western side of the entrance. This buoy lies about 1 mile W. S. W. ¾ W. from the red buoy off Forbes Point.

NOTE, ED.—It is proposed by the Lighthouse Board to recommend the placing of fog whistles at Buchon and Arguella ; also a light of the fourth order, together with a fog whistle, at Point Gorda.

Starr Rock, Bellingham Bay—A third-class nun buoy, painted red and black, in horizontal stripes. This rock has four feet of water on it at extreme low tides. From the buoy, the end of Whatcom wharf bears N. ¼ E.; south smoke-stack of Sehome Saw Mill, S. S. E. ⅜ E.; northeast corner of Fair Haven wharf, S. ¼ E.

To mark the Channel off Port Ludlow.

Colvos Rocks—Second-class nun buoy, No. 2, painted red. Foul-weather Bluff bears E. by N.; Basalt Point, N. W. ½ W.; Bush Point, N. Placed in 24 feet water, hard, sandy bottom, about half a mile south-east of Colvos Rocks.

Tala Point—First-class spar buoy, No. 1, painted black. Foul-weather Bluff bears N. E. by E. ½ E.; Tala Point, S. E. by S. Placed in 15 feet water, hard, sandy bottom, off Tala Point.

To mark the Channel entering Steilacoom Harbor.

Toliva Shoal—Second-class nun buoy, red and black horizontal stripes. East side of Fox Island bears N. ¼ E.; north side of McNeil Island, W. ¾ N.; east side of Ketrow Island, S. ½ E. Placed in 27 feet water, in the center of the shoal, and may be passed on either side by giving it a good berth.

Itsania Shoal—Second-class nun buoy, red and black horizontal stripes. Moody Point bears N. E. by E. ¾ E.; Dickerson's Point, S. S. W. ¼ W.; east side of Hartstene Island, N. N. W. Placed in 24 feet water, rocky bottom, on the north side of the kelp. Vessels bound to Olympia should leave it on the port hand.

To mark the Channel entering Olympia Harbor.

Olympia Shoal—Third-class can buoy, No. 2, painted red. Duffelmyer's Point bears N. by W. ¼ W.; wharf at Olympia, S. E. ½ S.; Priest Point, S. E. ½ E. Placed in 24 feet water, and marks the shoal in Olympia Harbor, N. by E. ½ E. from Butler's Cove.

Notices of Rocks, Shoals, and Dangers

ADJACENT TO WEST COAST UNITED STATES.

Sunken Rock off Middle Farallon—This danger has 5¼ fathoms of water upon it at low water, with deep water from 8 to 15 fathoms close around it; but with a large sea on, a break has been seen upon it by pilots and the lighthouse keeper.

It lies S. 25 degrees W. by compass, distant ⅝ of a mile from the Middle Farallon; and N. 72 degrees W., distant 2¼ miles from South Farallon Lighthouse.

The water between this rock and the Middle Farallon reaches 18 fathoms and from 15 to 20 fathoms between it and the South Farallon.

Located in July, 1875, by the U. S. Coast Survey.

Hurst Shoal, near South Farallon—A shoal or patch has been discovered (September, 1875) by Lieut. Com. H. C. Taylor, Assistant U. S. Coast Survey, S. 50 degrees E., and distant ½ mile (both approximate) from the South Farallon light, with six and one-half fathoms upon it sloping down from that to 16 and 18 fathoms on the outside, and to 13 and 15 fathoms on the inside,

Bursley Shoal—This shoal, reported in former editions of this Almanac as being 80 miles S. S. W. from the South Farallon Island, has been thoroughly searched for by the U. S. Coast and Geodetic Survey, and its existence is denied by that authority. 300 fathoms, no bottom found in asserted locality.

Reed or Falmouth Rocks—These dangers heretofore reported as existing in latitude 37° 28′ N., longitude 137′ 28° W., have been searched for by the U. S. Coast and Geodetic Survey, and also by the U. S. Navy; the soundings reached on two sides of the locality were 2,888 and 3,003 fathoms.

Dangers near Point Sur.

From the Coast and Geodetic Survey—New.

From Point Sur, three miles to the southward, stretches an immense field of kelp, which is full of danger; vessels should not approach the line of kelp within a quarter of a mile, and at a point 2 miles south of Point Sur not even as close as that, as a spur of hidden danger projects *outside* the line of kelp.

Constantine Rock, *a new location*—A sharp rock, with 8½ feet of water upon it, has been located by the U. S. Coast and Geodetic Survey in the northern part of Esteros Bay, near Cayucos Landing. It is half a

mile off the rocky shore, to the northward, and 2 1-6 miles S. W. 3-5 W. from the northwest corner of the large warehouse on the inner end of Cayucos Wharf; and 1 7-10 miles W. S. W. from the Mouse Rock, which lies half a mile out from the same warehouse. There is good water around it, and no kelp. A first-class can buoy, painted red and black horizontal stripes has been placed in 6½ fathoms water, 150 yards S. of the reported position of this rock. Masters of vessels are recommended not to pass between this buoy and the shore.

San Luis Obispo Harbor—A rock, marked by kelp, S. E. by S. ⅝ S. (magnetic), 1⅛ miles distant from the end of People's Wharf. Has 14 feet on it at mean low water. Located by U. S. Coast Survey.

Entrance to San Luis Obispo Harbor—A rock (no kelp on it) with 18 feet least water, W. S. W. (magnetic) from Whaler Island, distant 1⅝ miles. A rock with 18 feet least water, S. W. ⅛ W. from Whaler Island, distant 1½ miles. Located by U. S. Coast Survey.

The position of the whistling buoy off Port Harford has been lately changed. It is now in 19 fathoms water with the following ranges Whaler Island N. W. ¾ W.; Pecho Rock N. W. by W. ⅞ W.; White Rock in range with Souza Rock (on which there is but 16 feet at low water) in line with fence N. N. E. Navigators are strongly recommended to leave the whistler on the starboard hand going in.

A rocky shoal on which there is about 22 feet water, has been reported by fishermen as ¾ of a mile S. E of the whistling buoy, off the entrance to Port Harford.

Von Helm Rock—This newly reported danger lies broad off shore, about 1½ miles southeastward of the opening of Santa Rosa Creek; the rock must be very sharp and have 3 or 4 fathoms over it. The approximate position places it 2⅓ miles S. 61½° E. from Cambria Rock, 7 miles S. 40½° E. from San Simeon Wharf, and 7⅔ miles N. 71° W. from Point Esteros.

Dangerous Shoal in the Northern Approach to San Miguel Passage.

A dangerous shoal lies to the northward of the N. W. point of Santa Rosa Island, and about one mile from shore, with a least depth of eleven feet upon it; the bottom being rocky, with occasional specimens of red and white coral. There is no kelp on this shoal, and no breaker, except in very heavy weather.

The depths in the vicinity range from seven to ten fathoms on all sides, with rugged and irregular bottom.

The following bearings and distances fix the position of the center of the shoal: Northernmost point of San Miguel Island (known as Harris Point), W. by N. 8¼ miles. Outermost rock off N. W. point of Santa Rosa Island (known as Einder), S. by W. ½ W., 1½ miles. The most prominent point in the north face of Santa Rosa Island (Brockaway Point) E. N. E. ⅝ E., 5¼ miles. Eastern end of San Miguel Island (known as Cardwell Point) W. S. W. ¼ W., 4¼ miles.

All vessels attempting the San Miguel Passage are cautioned not to allow the outer rock off the northwest point of Santa Rosa to bear anything to the southward or westward of S. by E., and sailing vessels are specially recommended to avoid this passage altogether, as the light airs and calms under the lee of San Miguel Island, and the strong currents in the vicinity, combine frequently to drive a vessel upon this dangerous spot.

Other dangers, not yet developed, are believed to exist to the eastward of this.

To the northward of the shoals, and three-fourths of a mile distant, a band of kelp extends one-fourth of a mile in an easterly and westerly direction, with twelve and fifteen fathoms of water in and around it, and may serve as a warning when thick weather obscures the shore line in the vicinity. Located by the United States Coast Survey

Crapo Rock—An isolated rock, having but 18 feet water upon it, lies in the anchorage off Dead Man's Island, San Pedro Bay. It is ¾ of a mile W. by N. ¾ N. from Dead Man's Island, and has 4½ fathoms all around it. It is now marked by a bell buoy. Located by the United Coast and Geodetic Survey.

Cortes Shoal—This shoal stretches about seventeen miles, from latitude 32 degrees 24 N., longitude 118 degrees 59½ W., to latitude 32 degrees 32 N., longitude 119 degrees 17½ W., but curves slightly to the southwest. Within the fifty fathom curve, the general trend is parallel with the islands of Santa Catalina, San Clemente and San Nicolas. It has an average and nearly uniform width of three and a half miles. (Sometimes the current runs strong against the N. W. wind.) The nature of the bottom is hard, composed of white sand, broken shells, and fine coral at the southeast portion, and sand with broken shells at the northwest. The shoalest and most dangerous part is that known as the Bishop Rock, lying five miles from the southeast tail of the bank, and having but two and a half fathoms of water upon it. Around this danger the depth increases gradually, and in an extent of two and a half miles in the general direction of the bank reaches but fifteen fathoms. The position of these rocks is (approximately) latitude 32 degrees 25¾ N., longitude 119 degrees 05 W. From the northwest end of the island

of San Nicolas the rock bears S. E. ½ S., distant fifty-seven miles; and from the southeast end of the island of San Clemente it bears S. W. ¼ S., distant forty-six miles. From the Bishop Rock to the west end of San Miguel Island the course is N. W. ¼ W., and distant one hundred and fifteen miles.

New Hope Rock.—A pinnacle rock, ten or twelve feet under water, breaking in a moderate westerly swell; bears due northwest (magnetic) from Point Loma lighthouse; it is one-half a mile from shore, and inside the line of the kelp. Reported by Capt. P. W. Packard, pilot of San Diego Harbor.

San Geronimo Island—The position of this island, as determined by the U. S. C. S., is latitude 29 degrees, 47 minutes, 13 seconds N., longitude 115 degrees, 47 minutes, 52 seconds W.

Sacramento Reef—This danger lies S. E. ½ S. (magnetic) from San Geronimo Island, distant 6 miles. It is entirely surrounded with kelp.

San Martin's Island—The position of this island, as determined by the U. S. C. S., is latitude 30 degrees, 28 minutes, 52 seconds N., longitude 116 degrees, 06 minutes, 37 seconds W.

Ben's Rock—This danger lies due south (magnetic), distant three miles from St. Martin's Island; it is about 500 yards in diameter, varying in depth from 1½ to 10 fathoms.

The Cordell Bank, off Point Reyes, Cal.

LOCATED BY THE U. S. COAST SURVEY.

The middle of this bank lies 20 miles W., 20 degrees S. (compass) from Point Reyes light, and 28 miles N., 64 degrees W. from the South Farallon light, which shows just above the horizon. Table Mountain Peak is open one-quarter point south of Point Reyes.

Within the fifty fathom curve the bank is eight miles long, N. N. W. and S. S. E., with an average width of 2¼ miles. There is a depth of 25 fathoms in several places upon it, but a minute examination may develop less. Within the thirty fathom line the bottom is rocky, and marked by live barnacles and reddish tubular forms with red slime inside; between 30 and 40 fathoms, finely broken white shells were found, and beyond 40 fathoms the bottom is composed of coarse, black sand, with gravel and broken shells. Seals, sea lions, marine birds, and schools of whales were found over the bank.

To the westward the depth increases very rapidly, reaching 270 fathoms within 1½ miles; to the southward, 275 fathoms in 4½ miles; to

the northward it has not been fully developed; to the eastward the depth increases gradually to 66 fathoms in seven miles, and then decreases to Point Reyes. The currents on the banks are irregular and weak.

Should the South Farralon and Point Reyes lights be obscured by low fog or haze, the following compass bearings will locate it: Table Mountain Peak, N. 81 degrees E.; Ross Mountain, N. 10 degrees E.

Dangers off Cape Mendocino.

LOCATED BY THE U. S. COAST SURVEY.

The bearings and distances are from the Lighthouse.

I. The "Great Break," a rock having 25 feet of water upon it, S. 68 degrees W. (compass), three miles distant; from the south rock of Blunt's Reef it bears S. 5 degrees E., distant ¾ of a mile. It breaks very seldom; 15 to 20 fathoms around it.

II. A rock having 11 feet of water upon it, S. 72 degrees W., 2¾ miles distant; from the South Rock of Blunt's Reef it bears S. 30 degrees E., distant ½ of a mile.

III. Heavy ground breaks over an area of a quarter of a mile, in 9 and 10 fathoms, S. 77 degrees W., 2 miles distant.

IV. A rock having a quick, sharp, and well-defined breaker, S. 52 degrees W., 1⅞ miles distant. Not yet sounded upon; has 15 fathoms alongside of it.

V. A rock having seven feet water upon it, S. 25 degrees W., one mile distant; a sharp breaker has been located just outside of it, and just inside of it the top of a rock was seen in the trough of a heavy swell. Has 12 fathoms outside of it.

VI. A ledge several hundred yards in extent, having 12 feet upon it, S. 7 degrees W., distant 1½ miles; has 12 fathoms outside it.

VII. A rock having 13 feet of water upon it, S. 75 degrees W., distant 1⅛ miles; it has 13 fathoms around it. One-quarter of a mile inside of it there is a distinct, well-defined breaker; and three-eighths of a mile inside was seen the top of a rock in the trough of the sea.

VIII. A rock, not yet sounded upon, N. 82 degrees W., distant one mile; it gives a sharp, well-defined breaker; another rock lies about a quarter of a mile northeast of this. The first has 11 fathoms alongside of it.

IX. A rock having 22 feet of water upon it, N. 66 degrees W., distant 1⅝ miles; it has 9 fathoms around it. To the southward of this rock,

over an area of three-eighths of a mile, three heavy ground-breaks were seen in 8½ to 10 fathoms water.

X. A rock having 12 feet of water upon it, W. ½ S., distant six-tenths of a mile from the Cape Rock, lying off Cape Fortunas; it has 13 fathoms of water around it.

These dangers show that the passage between Blunt's Reef and Cape Mendocino should be avoided; sunken rocks extend nearly a mile off the coast from Shelter Cove to Cape Mendocino, and vessels should not approach it too closely.

The South Rock of Blunt's Reef bears S. 82 degrees W., distant two and nine-tenths miles from the lighthouse.

Sunken Rock off Cape Mendocino, Cal.—Inside of Blunt's Reef is a sunken rock, with six feet on it at mean low water; no kelp about it, and its summit is only from two to three feet in diameter, soundings around it deepening rapidly to 9 and 15 fathoms on all sides. Lies one and seven-tenths miles S. W. ¾ W. (magnetic) from the lighthouse on Cape Mendocino. The ranges are: The center of the southern slope of Sugar-loaf Rock (half-way between summit and base) on with the Lighthouse, and the point of land at Centerville showing half-way between a small rock inside of False Cape Rock and the point of land at False Cape, which latter is on with the outer edge of woods on the point of land at Centerville. Navigation between Blunt's Reef and Cape Mendocino is extremely hazardous; vessels bound around the Cape should pass two miles to the westward of Blunt's Reef. Located by the U. S. C. S.

Cape Fortunas (False Mendocino)—Off this cape there is a rock with 12 feet of water, bearing W. ½ S. from the Cape Rock, and distant six-tenths of a mile.

Chase Ledge—A rocky ledge several hundred yards in extent, not well marked by kelp, and has four fathoms of water upon it at mean low water, with a depth of from 13 to 15 fathoms around it. It lies about 1⅞ miles off shore, directly in the course of steamers to and from the southward of Crescent City, and in heavy southeast weather must break. The following magnetic bearings and distances are given to locate it: From Crescent City light it bears S. 40 degrees E., 1 7-10 miles; from Round Rock (45 feet high), S. 25 degrees E., between 8 and 9-10 of a mile; from Mussel Rock (7 feet high), S. 17 degrees W., 7-10 of a mile. Located by the U. S. Coast Survey.

Outer Dangers of Crescent City Reef.

Jonathan Rock—An isolated sunken rock upon which the sea breaks heavily, deep water all around it. It lies 3⅛ miles S. 43½° east from St. George's Reef (N. W. Seal Rock) lighthouse.

Mansfield Break—This is an extensive reef upon which the sea continually breaks; deep water all around it. It lies 2 1-5 miles S. 37 degrees E. from St. George's Reef (N. W. Seal Rock) lighthouse.

NOTE, ED—The above notices are kindly furnished to me by Prof. Davidson, Assistant U. S. Coast and Geodetic Survey.

Sunken Rock off the Coast, south of Crescent City—This danger lies nearly one mile off the Point, near Wilson's Creek, 9¾ miles southward of Crescent City light.

The top is circular, and about four feet in diameter, with only three feet upon it at low water; and within two boats' length around it the depth is 15½ fathoms. The sea rarely breaks upon it, and it cannot be otherwise distinguished at a ship's length. There is no kelp to mark it. From it we have the following compass bearings and distances: Sister Rocks, N. W. by N., four miles; Far Island, E. by N., ½ mile.

The Sister Rocks lie half a mile off the coast, about 5¾ miles southward of Cresent City light.

Dangers on The Coast, from Shelter Cove and Cape Mendocino to Cape Gregory.

Sunken rocks, extending in some cases nearly one mile off shore, and occupying the greater part of the passage between Blunt's Reef and Cape Mendocino, were discovered by Assistants George Davidson and Aug F. Rodgers, U. S. C. S. Upon some of these rocks the sea breaks only occasionally, with a heavy swell on at low water, and can rarely be detected when strong winds are blowing. Their positions are now accurately laid down on the U. S. charts. A vessel cannot safely approach the above line of coast within less than a mile and a half, or Blunt's Reef within a mile.

Sunken Rock in Chetko Anchorage, Oregon—A sunken rock, 12 feet long by 6 feet wide on top, and having 15 feet of water upon it at low water, has been discovered and located by the U. S. Coast Survey. Close around it the depth is 5 fathoms. The kelp grows upon it, but not sufficiently dense to be readily noticed.

It lies S. by E. ½ E. by compass, distant 700 yards from the large white house on the west point of the mouth of Chetko River. Vessels seeking

anchorage here should keep the house always northerly of a N. by W. bearing, and anchor in 6½ fathoms sandy bottom, with the inner or northerly rock above water, bearing N., distant 370 yards, and the south west rock bearing N. W. by N. distant 230 yards. In this position the white house is open to the west of the inner or north rock, and the sunken rock described bears N. E. by N., distant 175 yards. The two other sunken rocks upon which the sea breaks, and hitherto known, lie respectively S. 30 degrees E., distant three-quarters of a mile, and S. 30 degrees E., one-half mile from the white house.

Siuslaw River—A second-class nun buoy, painted with black and white stripes, was placed Sept., 1887, in 9½ fathoms water. It bears W. S. W. about 2 miles from a shanty on the north shore.

Mack's Shelter, Oregon, is in latitude 42 degrees, 14 minutes, 30 seconds N., longitude 124 degrees, 24 minutes, 30 seconds, W., 14 miles northward of Chetko Cove, and is distinguishable upon almost any approach by Mack's Reef, lying off Mack's Point. This consists of a line of rocks, the most prominent of which range from 100 to over 200 feet in height; the highest, called Mack's Arch, being at the southern extremity, and unmistakable from the large opening through it.

The course is for the anchorage, with Mack's Arch on any bearing from N. W. by N. to E. ¾ N., leads to 350 yards distance from the arch, carrying not less than 15 fathoms of water, when it changes to pass to the eastward, not nearer than 50 yards, and then leads along the line of the reef in the direction of the inner or northern end, where it appears to join the shore. With Mack's Arch bearing S. by E. ¼ E., and Mack's Point bearing N. N. E. ½ E., a good anchorage is had from 300 to 400 yards off the reef, in 6½ fathoms of water, sandy bottom. Inside of this is an inner anchorage separated from the other by a thick belt of kelp, stretching from the beach to the reef, but through which there is a clear channel.

With the highest point of Mack's Arch bearing S. ¾ E., the course for entering is N. ¾ W., leading through the channel in from three and a half to four fathoms of water, and avoiding a *sunken rock* with only two feet of water on it at low water, which lies at the edge of the kelp on the eastern side. From the northern or inner end of the channel, the course leads to the westward, and good anchorage is had just inside the kelp, in from four to five fathoms water, sandy bottom; Mack's Point bearing E. ¾ N., and Mack's Arch S. by E. ½ E.

There are passages between the rocks, leading in to the inner and outer anchorages, apparently free from danger; but it is recommended that they should not be used until they are closely surveyed.

Wood and water can be obtained here, but no other supplies.

Coquille Rock—Located by the U. S. Coast Survey. About one mile W. S. W. from the extremity of the rocky cliffs on the south side of the entrance to Coquille there are two rocks awash, doubtless a continuation of the high rocky masses off the point. But outside of this reef there is a sunken rock upon which the sea seldom breaks, except in a heavy swell from the S. W. This danger lies on the prolongation of the present jetty, a little more than 1⅝ miles from its extremity. From the 155 feet rocky butte, the danger lies N. 85 degrees W., distant 1¾ miles, and 1⅛ miles N. 38 degrees west from the rocks.

Baltimore Rock, off Cape Gregory—Reported in 1873, and recently located by the U. S. Coast and Geodetic Survey. This rock is a little more than half a mile N. 48 degrees W. from Cape Gregory light, on the direct extension of the line of the point; it has 10 feet of water upon it, with 6½ fathoms inside of it, and 13 fathoms one-sixth of a mile outside of it. Between this danger and the Whistling Buoy, (off Koos Bay entrance), the least water is 12 fathoms, and between it and the bar the depth decreases from 11 to 4 fathoms.

This rock was first discovered in 1861, by Jas. S. Lawson, Assistant U. S. C. S.

Flattery Rocks—The UMATILLA REEF lies 12½ miles S. 15 degrees E. from the lighthouse on Tatoosh Island. It is partly sunken and partly visible, with deep water between it and the outer one of the Flattery rocks, which lie seven-eighths of a mile to the eastward.

Sonora Reef—This is a dangerous reef, extending southwardly from Cape Elizabeth to within one mile of Point Grenville. The southern tail breaks only in heavy weather. Located by the U. S. Coast and Geodetic Survey.

Strait of Juan de Fuca—A patch of kelp is found one mile south of the southeastern point of Bellevue or San Juan Island, and eight and a half miles N. W. by W. ¼ W. from Smith's Island, with three fathoms marked on it; but it is reported that H. B. Co's steamer "Otter" found only six feet.

Bearing W. ½ S. from Smith's Island; and eight miles distant, is another field of kelp, nearly a mile in extent, having five fathoms throughout it.

Rock in Roche Harbor, Haro Strait, Scout Patch—This dangerous rock, which narrows considerably the northern passage into Roche Harbor, lies in the center of the channel westward of Pearl Island. It is half a cable long, with 17 feet at low water springs, and bears from the center of Neck Islet, (which is connected by a narrow sand-spit to the western end of Pearl Island), S. W. ¾ W., distant one and three-

fourths cables. A narrow five-fathom channel at low water exists on the eastern side of the Patch.

Unit Rock in the Canal de Haro—When eight and a half miles within the south entrance of the strait, the width decreases to three and a half miles, having Darcy Island on the west; off its N. E. face lies a small islet, and off the S. E. face lie very large fields of kelp, stretching far off to the southeast. In 1863, in one of these fields, was discovered a sharp pointed rock, called Unit Rock, lying E. by S. ½ S. (magnetic), from the S. E. part of the island, and distant three-quarters of a mile. The sharp apex of this rock was about three feet above water at the very lowest tides.

Since this discovery, several rocks, covering a space of half a square mile, on the same bearing from the southeast point of Darcy Island, have been found. They are marked by a field of kelp, and one point uncovers at the lowest tides. Near mid-channel a depth of 155 fathoms is found.

Lawson Reef—This ledge lies at the southeastern part of the southern entrance of Rosario Strait, Washington Sound, and directly off the western entrance to Deception Pass. Its general direction is north and south (by compass), and within the eight-fathom curve is six-tenths of a mile in length, and three-tenths of a mile in breadth. The kelp patch marking it is half a mile long north and south, and lies over the part of the reef having six fathoms of water and less. The shoalest part is about 170 yards in extent, and has three and three-quarters fathoms over it at mean low water.

The depth of water increases very rapidly away from the reef, but more particularly on the northeast side, where a depth of thirty fathoms is found within 200 yards of the ten-fathom curve. On the west side the thirty-fathom curve lies a quarter of a mile from the ten-fathom curve. Within half a mile from the ledge, on the east and south sides, the depth of water is 50 fathoms.

The following compass bearings and distances locate the shoalest part, which is about the middle of the ledge. Deception Island bears N. 59 degrees E., distant 1.75 miles; Burrows' Inlet, just open by Allen Island, N. 22 degrees W., distant 4.5 miles; Eastern Point of Watmough Head, S. 85 degrees W., distant 4 miles; Smith's Island Lighthouse, S. 23 degrees W., distant 7.3 miles; Point Partridge, S. 10 degrees E., distant 10.5 miles. This reef has been named from James S. Lawson, U. S. C. S.

Portlock Bank—Latitude 58 degrees, 16 minutes N.; longitude 149 degrees, 42 minutes W. This extensive bank was located in the given position by the U. S. Court Survey, in 1867; it is about 100 miles E. N.

E., easterly (true) from St. Paul's, Kodiak Island. The shoalest water found on a single line of soundings only was forty-five fathoms in the above position; bottom, black sand, pebbles and mud. Detailed examinations are necessary to give the limits of this bank, which is believed by soundings given by Portlock, Cook, and others, to be very extensive.

Ounimak Bank—Latitude 53 degrees, 35 minutes, to 53 degrees, 40 minutes N.; longitude 164 degrees, 10 minutes, to 164 degrees, 30 minutes W. The extent of this rich COD BANK, lying eastward of Ounalaska Island, is not known. Soundings in fifty and sixty-five fathoms were obtained upon it by the U. S. Coast Survey in 1867, in thick weather, with approximate positions as above given, being sixty-five miles E. S. E. (true) from the middle of Akoutan Passage, and forty miles S. S. E. (true) from Ounimak Passage; bottom, black and white sand, with pebbles.

Suwanee Rock—This rock, on which the U. S. ship *Suwanee* was wrecked in July, 1868, lies in Shadwell Passage, about 150 feet from Hope Island, and is nearly awash at low water. In entering this passage from the Goleta Channel, give a good berth to the point of Hope Island, (as the rock lies a little to the northwest of a line drawn from this point to the nearest point of Vansittart Island), then around into Shadwell Passage with eight fathoms of water, gradually deepening to twelve fathoms, when abreast of Lone Tree Island. Unless well acquainted with this locality, or under charge of a competent pilot, it is not recommended for ships to use this passage. Bates' Passage, to the southward and eastward of Vansittart Island, is a deep, clear channel, and the distance a very little greater.

Starr Rock—Bellingham Bay. This rock is of small extent, with only 4 feet water on it at lowest tides. It lies only 160 to 200 yards N. N. W. of the north angle of the southernmost wharf. It is nearly in range with the outer end of the old coal wharf, and the coal bunkers at the head of the Sehome wharf.

Marked by a buoy; see list of Buoys.

Located by the U. S. Coast Survey, Sept., 1888.

New Discoveries.

Bellingham Bay—A single boulder with 8 feet water over it has been discovered about midway between Point Frances and Eliza Island. It bears N N. W. ¾ W from the north end of Eliza Island, and S. W. by W. ¼ W. from Chuckanut Rock.

A Small Shoal Spot about 328 yards off Eliza Island, with a least depth of 5 feet, and is 40 to 50 feet in length. There is fifteen fathoms outside and from 7 to 9 fathoms inside of it. Bearings from it: Dead tree on extreme west point of Eliza Island, S. S. E. ¾ E.; South point of Lummi Island S. by W.

A Shoal Spot on the east side of Lummi Island, about 1¾ miles from the south end, is about 110 yards off shore, and has a least depth of 8 feet on it. N. end of Eliza Island bears E. Tangent to east side of Point Frances, N. ¾ W.

A Shoal Spot off the entrance to Inati Bay is about 110 yards long in a N. and S. direction. Its shoalest spot is just bare at low water. N. end of Eliza Island bears E. ¼ S. Tangent to Point Frances, N. ⅛ W.

Sitka Harbor—Keen Rock, in the Middle Passage to Sitka Harbor, Alaska.

This dangerous rock is not shown on any chart. It is about ten yards in diameter. The least depth found upon it was 16 feet at *lower low water*, dropping suddenly to four fathoms on all sides; seven fathoms were found within a boat's length. The rock lies dangerously near the track of vessels using the middle passage, being near a spot where the charts show 17 fathoms.

BEARINGS (MAGNETIC) OF PROMINENT OBJECTS FROM KEEN ROCK.

Variation 28° 54′ E.

Left extreme of Rocky Island (Nepovorohnoi Rock).....N. 29° W.
Right extreme of Volga Island.....N. 38° 30′ E.
Right extreme of Quitoway or Whale Island.....S. 71° E.
Left extreme of Mokhuatoi or Wooded Island.....N. 68° 30′ W.

The course adopted by Pilot J. W. Keen is, in entering, to round Surf Rock (Polivnoi Island) as soon as possible, and to bring its center on a bearing of S. W. by S. (magnetic), steering mid-channel N. E. by N. This course leads 200 yards clear of the rock. Ten, fifteen and eighteen fathoms are found near at hand in the channel. In summer the spot is sometimes marked by kelp.

Located, May, 1879, by U. S. Steamer "Alaska," and Pilot J. W. Keen.

Rush Reef—Near Great Kyska Island, latitude 52 degrees, 6 minutes N.; longitude 177 degrees, 54 minutes E.

Reef—Marked as doubtful on charts, but does exist in latitude 51 degrees, 58 minutes, 30 seconds N.; longitude 177 degrees, 53 minutes E.

New Harbor—Discovered in Belkofsky Bay, Alaska, 1½ miles long and one mile wide, perfectly landlocked; good holding ground in soft, sticky mud, with seven fathoms at low water; no dangers; entrance full ⅜ mile wide, with ten fathoms bold water.

Position of station: latitude 55 degrees, 8 minutes, 48 seconds N.; longitude 162 degrees, 7 minutes, 22 seconds W. Variation 21 degrees, 8 minutes E. High water at full, and change 11 hours, 50 minutes A. M. Spring rise, 6 feet, 9 inches.

The above three notices are furnished to me by Lieut. Hand, of the U. S. revenue steamer "Richard Rush."

Eureka Rock—This is a newly discovered danger in Surge (or Southern) Narrows, Peril Strait, S. E. Alaska. The S. W. end of Poroga Island on with Suloia Point off Chichagoff Island (which, according to the chart, should bear about S. ½ W.), passes over the rock, from which the northern edge of Poroga Island bears S. E. by E. ½ E., approximately. There are about 8 feet of water over the rock, which appears to be a pinnacle about six feet in extent.

NOTE.—*According to the chart, Eureka Rock should be about* 400 *yards N. ½ E. from the western extreme of Poroga Island, and a little more from Chichagoff Island shore.*

To avoid it, therefore:

Coming from the Northward—When Liesnoi Island bears to the eastward of north, the vessel being in mid-channel, steer for the western shore of the passage, and keep within 300 yards of it, until the S. W. point of Poroga Island bears S. E., when all danger will be cleared. This direction clears also the Wayanda Rock, eastward from Eureka Rock.

Coming from the Southward—When up with the S. W. end of Poroga Island, in mid-channel, steer for the western or Chichagoff Island shore, and keep within 300 yards of it, until the eastern point of Poroga Island bears S. E. by S., when the course in mid-channel is clear of these dangers.

The above was furnished to me by the U. S. Coast and Geodetic Survey; the rock was discovered by Pilot W. E. George, of the steamer "Eureka," which struck upon it April 26th, 1883.

New Discoveries in Alaska Waters.

Stewart Rock in Security Bay, Kuia Island, Chatham Strait—Has a least depth of 2½ feet over it. Point Lookout bears S. S. E. ⅞ E., distant ⅝ mile; S. W. point of Cleft Island, N. W. ⅜ W., distant ¼

mile ; Indian Rock, S. S. W. $\frac{7}{8}$ W., distant $\frac{1}{4}$ mile. From this rock a reef, a large portion of which shows at low water, extends in to thebight of Cleft Island. Discovered by Lieut. Com. H. E. Nichols, U. S N., U. S. Str. "Pinta." The "Pinta" anchored with the village open to the eastward of Cleft Island in 10 fathoms water, muddy bottom, and excellent holding ground.

Rock in Cook's Inlet—A small cluster of rocks above water lies 8 miles E. by S. from the southwest point of St. Augustine Island. Reported by Capt. Anderson, Alaska Commercial Co., to the U. S. Coast Survey.

Dangers in Neva and Peril Straits—Com. J. B. Coghlan, U. S. N., U. S. Ship "Adams," reports that in Neva Strait a ledge of rocks (not on the charts) lies about 200 yards from the Baranoff Island shore, just clear of the channel between that shore and the Kane Islets, bearing N. $\frac{1}{2}$ W. (magnetic) from the Islets. The ledge is bold, with two always uncovered rocky lumps.

Surge Narrows, Peril Strait—There is a greater extension of rocky ground northward from Porogo Island than before reported. This consists of a rocky patch with as little as two fathoms on it, besides one dry rock above Poroga Island, and which narrows the channel between itself and Chichagoff shore to about 150 yards. Hence, in passing these narrows the navigator should pass within a hundred yards of Chichagoff shore, going either north or south ; slack water lasts only about twenty minutes, and the current, at its height, runs 10 knots an hour.

Fish Bay, Schulze Cove—This cove is wrongly placed on the U. S. Hydrographic charts. It is close to Fish Point, the head of the cove being separated from Peril Strait, north and east of Poroga Island, by an isthmus about fifty feet high, and only two cables wide.

—o—

Shipping Commissioner.

The general business of the Commissioner is to afford facilities for engaging seamen, by keeping a register of their names and characters ; to superintend their engagement and discharge ; to provide means for securing their presence on board, and to facilitate the making of apprentices to the sea service. He shall hear and decide any question between a master, owner or consignee and any of the crew, and any award so made by him shall be binding on both parties.

Synopsis of the Shipping Act, approved June 26, 1884.

(*With Amendments up to June 21st*, 1886.)

APPLYING TO VESSELS OF THE UNITED STATES.

SECTION 1.—Relieves vessels, under certain conditions, from the penal tonnage tax heretofore levied for the employment of alien officers under the grade of master.

SEC. 2.—Upon application, a consular officer can discharge a seaman who has completed his shipping agreement, but no extra wages are to be paid, except as provided in this act.

SEC. 3.—Upon application of a seamen for discharge at a foreign port, on the ground that the voyage had been unnecessarily prolonged, or that he has received any injury in the service of the vessel, he shall receive one month's extra wages if so discharged.

SEC. 4.—A seaman can procure his discharge in a foreign port and one month's extra wages, if the inspectors report that the vessel was sent to sea unsuitably provided, through neglect or design.

SEC. 5.—If a vessel is sold in a foreign port, the seamen are entitled to one month's extra wages, unless other employment is given them as provided.

SEC. 6.—If desertion of a seaman is caused by cruel treatment, he shall be discharged by the consular officer, and receive one month's extra wages.

SEC. 9.—All vessels in foreign ports, and bound to a home port, are required to transport destitute seamen, on certain terms.

SEC. 10, as amended.—Prohibits the payment of advanced wages to a seaman before leaving the port at which he is engaged. *Provided*, That it shall be lawful for any seamen to stipulate in his shipping agreement for an allotment of all or any portion of the wages which he may earn to his wife, mother, or other relative, or to an original creditor, in liquidation of any just debt for board or clothing, which he may have contracted prior to engagement, not exceeding $10 per month for each month of the time usually required for the voyage for which the seaman has shipped, under such regulation as the Secretary of the Treasury may prescribe; but no allotment to any person or corporation shall be lawful. And any master, owner, consignee, or agent of any foreign vessel who has violated this section, shall be liable to the same penalty that the master, owner, or agent of a vessel of the United States would be for a similar violation.

SEC. 11. Every vessel is to be provided with a slop chest, containing a suitable complement of clothing, etc., to be sold to the seamen at a stipulated advance on cost. This section does not apply to vessels plying between the United States and Mexico, Central America, and some other countries on the Atlantic seaboard, nor to fishing or whaling vessels.

SEC. 12—Abolishes consular fees for services to vessels and seamen.

SEC. 13—Provides that a master shall require a written statement from the consular officer of all official services rendered by him, and furnish it to the Collector of the district at which he shall first arrive.

SEC. 14—Abolishes the old tonnage tax of 30 cents a ton, and imposes the tax at the rate of 3 and 6 cents, as specified, the total not to exceed 15 and 30 cents per annum, under certain conditions and stipulations.

SEC. 15—Abolishes the marine hospital tax on seamen.

SEC. 18—Limits the individual liability of a shipowner to the proportion of any or all liabilities that his individual share bears to the whole; and the aggregate liabilities of all the owners of a vessel on account of the same shall not exceed the value of such vessel, and freight pending. *Amended*, to apply to all sea-going vessels, and also to all vessels used on lakes, rivers, or inland navigation, including canal-boats, barges, and lighters.

SEC. 19—Prohibits the payment of additional fees, when a seaman is re-engaged or re-shipped on a vessel making regular trips between the United States and foreign countries. It also allows the engagement of a seaman for a vessel in the foreign trade, for one or more round trips, or for a *definite period*, whatever the destination of the vessel.

SEC. 20—Permits the similar engagement of a seaman in a foreign port upon a vessel in the foreign trade, and waives the requirement of re-shipment of such seaman in a port of the United States; and also waives the requirement to return him to the United States.

SEC. 21—Permits the hailing port of a vessel to be either the port where she is documented, or the place where she is built, or where one or more of the owners resides.

Amendments of June 21st, 1886.

SEC. 1—On and after July 1st, 1886, no fees shall be charged or collected by Collectors or other officers of customs, or by inspectors of steam vessels or Shipping Commissioners for the following services to vessels of the United States, to wit: Measurement of tonnage and certifying the same; issuing of license or granting of certificate of registry, record, or enrollment, including all endorsements on the same, and bond, and oath;

indorsement of change of master; certifying and receiving manifest, master's oath, and permit; granting permit to vessels licensed for the fisheries to touch and trade; granting certificate of payment of tonnage dues; recording bill of sale, mortgage, hypothecation or conveyance, or the discharge of such mortgage or hypothecation; furnishing certificate of title; furnishing the crew list, including bond; certificate of protection to seamen; bill of health; shipping or discharging of seamen, as provided by Title 53 of the Revised Statutes, and section two of this act; apprenticing boys to the merchant service; inspecting, examining and licensing steam vessels, including inspection certificate and copies thereof; and licensing of master, engineer, pilot, or mate of a vessel.

SEC. 2—Shipping Commissioners may ship and discharge crews for any vessel engaged in the coastwise trade, or the trade between the United States and the Dominion of Canada, or Newfoundland, or the West Indies, or the Republic of Mexico, at the request of the master or owner of such vessel, the shipping and discharging fees in such cases to be one-half those prescribed by Sec. 4612 of the Revised Statutes.

SEC. 5—Provides that upon every documented vessel of the United States, the number denoting her net tonnage shall be deeply carved, or otherwise permanently marked on her main beam, and shall be so continued, under penalty of thirty dollars on every arrival in a port of the United States.

SEC. 7—Imposes a fine of thirty dollars on each arrival at port of a vessel of twenty tons or upwards, trading from district to district, or between different places in the same district, or carrying on the fishery if entitled to be documented, and not so enrolled or licensed.

SEC. 8—Foreign vessels are liable to a fine of two dollars for each passenger transported from a port in the United States to any other port in the United States.

Revised International Regulations to Prevent Collisions at Sea.

(Approved March 3d, 1885.)

RULES CONCERNING LIGHTS.

"ARTICLE 1—Every steamship which is under sail and not under steam shall be considered a sailing ship; and every steamship which is under steam, whether under sail or not, shall be considered a ship under steam.

"ART. 2—The lights mentioned in the following articles, numbered 3, 4, 5, 6, 7, 8, 9, 10 and 11, and no others, shall be carried in all weathers from sunset to sunrise.

"ART. 3—A sea-going steamship, when under way, shall carry—

"(*a.*)—On, or in front of the foremast, at a height above the hull of not less than 20 feet, a bright, *white* light, of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least *five* miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of twenty points of the compass; and so fixed as to throw the light ten points on each side of the vessel, viz: from right ahead to two points abaft the beam on either side.

"(*b.*) On the *starboard* side a *green* light of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least *two* miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of ten points of the compass; and so fixed as to throw the light from right ahead to two points abaft the beam on the *starboard* side.

"(*c.*) On the *port* side a *red* light of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least *two* miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of ten points of the compass; and so fixed as to throw the light from right ahead to two points abaft the beam on the *port* side.

"(*d.*) The green and red lights shall be fitted with inboard screens projecting at least three feet forward from the lights, so as to prevent them from being seen across the bow.

"ART. 4. A steamship when towing another vessel shall, in addition to her side lights, carry *two* bright, *white* lights in a vertical line, one over the other, not less than three feet apart, so as to distinguish her from other steamships. Each of these lights shall be of the same character and construction, and shall be carried in the same position, as the white light which other steamships are required to carry.

"ART. 5. (*a.*) A ship, whether a steamship or a sailing-ship, which from any accident, is not under command, shall at night carry, in the same position as the white light which steamships are required to carry, and if a steamship, in place of that light, *three* red lights in globular lanterns, each not less than ten inches in diameter, in a vertical line, one over the other, not less than three feet apart, and of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least *two* miles, and shall by day carry, in a vertical line, one over the other, not less than three feet apart, in front of but not lower than her foremast head, *three* black balls or shapes, each two feet in diameter.

"(*b.*) A ship, whether a steamship or a sailing-ship, employed in laying or in picking up a telegraph cable, shall at night carry, in the same

position as the white light which steamships are required to carry, and if a steamship, in place of that light, *three* lights in globular lanterns, each not less than ten inches in diameter, in a vertical line one over an other, not less than six feet apart. The highest and lowest of these lights shall be *red* and the middle one shall be *white*, and they shall be of such a character that the red light shall be visible at the same distance as the white light. By day she shall carry, in a vertical line, one over the other, not less than six feet apart in front of but not lower than her foremast head, *three* shapes, not less than two feet in diameter, of which the top and bottom shall be globular in shape and red in color, and the middle one diamond in shape and white in color.

"*(c.)* The ships referred to in this article, when not making any way through the water, shall not carry the side-lights, but when making way shall carry them.

"*(d.)* The lights and shapes required to be shown by this article are to be taken by other ships as signals that the ship showing them is not under command, and cannot, therefore, get out of the way.

"ART. 6. A sailing-ship under way, or being towed, shall carry the same lights as are provided by Art. 3 for a steamship under way, with the exception of the *white* light, which she shall never carry.

"ART. 7. Whenever, as in the case of small vessels during bad weather, the green and red side-lights cannot be fixed, these lights shall be kept on deck on their respective sides of the vessel, ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner to make them most visible, and so that the *green* light shall not be seen on the *port* side, nor the *red* light on the *starboard* side.

"To make the use of these portable lights more certain and easy, the lanterns containing them shall each be painted on the outside with the color of the light they respectively contain, and shall be provided with proper screens.

"ART. 8. A ship, whether a steamship or a sailing-ship, when at anchor, shall carry where it can best be seen, but at a height not exceeding twenty feet above the hull, a *white* light in a globular lantern of not less than eight inches in diameter, and so constructed as to show a clear, uniform, and unbroken light, visible all around the horizon, and at a distance of at least *one* mile.

"ART. 9. A pilot vessel, when engaged on her station on pilotage duty, shall not carry the lights required for other vessels, but shall carry a *white* light at the mast-head, visible all around the horizon, and shall also exhibit a *flare-up* light or lights at short intervals, which

shall never exceed fifteen minutes. A pilot vessel, when not engaged on her station on pilotage duty, shall carry lights similar to those of other ships.

"ART. 10. Open boats and fishing vessels of less than twenty tons net registered tonnage, when under way, and not when having their nets, trawls, dredges, or lines in the water, shall not be obliged to carry the colored side-lights; but every such boat and vessel shall, in lieu thereof, have ready at hand a lantern, with a green glass on the one side and a red glass on the other side; and on approaching to or being approached by another vessel, such lantern shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side, nor the red light on the starboard side.

"ART. 11. A ship which is being overtaken by another shall show from her stern to such last mentioned ship a white light or a flare-up light.

Sound-Signals for Fog, etc.

"ART. 12. A steamship shall be provided with a steam-whistle, or other efficient steam sound-signals, so placed that the sound may not be intercepted by any obstructions, and with an efficient fog-horn, to be sounded by a bellows or other mechanical means, and also an efficient bell. A sailing-ship shall be provided with a similar fog-horn and bell.

"In fog, mist, or falling snow, whether by day or night, the signals described in this article shall be used as follows, viz:

"(*a.*) A steamship under way shall make with her steam whistle, or other steam sound-signal, at intervals of not more than two minutes, a prolonged blast.

"(*b.*) A sailing-ship under way shall make with her fog-horn, at intervals of not more than two minutes, when on the starboard tack, one blast; when on the port tack, two blasts in quick succession, and when with the wind abaft the beam, three blasts in succession.

"(*c.*) A steamship and a sailing-ship, when not under way, shall, at intervals of not more than two minutes, ring a bell.

Speed of Ships to be Moderate in Fogs, etc.

"ART. 13. Every ship, whether a sailing-ship or a steamship, shall, in a fog, mist or falling snow, go at a moderate speed.

Steering and Sailing Rules.

"ART. 14. When two sailing-ships are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows:

"(*a.*) A ship which is running free, shall keep out of the way of a ship which is close hauled.

"(*b.*) A ship which is close hauled on the port tack, shall keep out of the way of a ship which is close hauled on the starboard tack.

"(*c.*) When both are running free, with the wind on different sides, the ship which has the wind on the port side shall keep out of the way of the other.

"(*d.*) When both are running free, with the wind on the same side, the ship which is to windward shall keep out of the way of the ship which is to leeward.

"(*e.*) A ship which has the wind aft, shall keep out of the way of the other ship.

"ART. 15. If two ships under steam are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other. This Article only applies to cases where ships are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two ships which must, if both keep on their respective courses, pass clear of each other. The only cases to which it does apply are when each of the two ships is end on, or nearly end on, to the other; in other words, to cases in which by day each ship sees the masts of the other in a line, or nearly in a line, with her own, and by night to cases in which each ship is in such a position as to see both the side lights of the other. It does not apply by day to cases in which a ship sees another ahead, crossing her own course, or by night to cases where the red light of one ship is opposed to the red light of the other, or where the green light of one ship is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

"ART. 16. If two ships under steam are crossing, so as to involve risk of collision, the ship which has the other on her own *starboard* side shall keep out of the way of the other.

"ART. 17. If two ships, one of which is a sailing-ship, and the other a steamship, are proceeding in such direction as to involve risk of collision, the steamship shall keep out of the way of the sailing-ship.

"ART 18. Every steamship, when approaching another ship, so as to involve risk of collision, shall slacken her speed; or, if necessary, stop and reverse.

"ART. 19. In taking any course authorized or required by these regulations, a steamship under way may indicate that course to any other ship which she has in sight, by the following signals on her steam whistle:

"One short blast to mean, 'I am directing my course to starboard.'

"Two short blasts to mean, 'I am directing my course to port.'

"Three short blasts to mean, 'I am going full speed astern.'

"The use of these signals is optional, but if they are used, the course of the ship must be in accordance with the signal made.

"ART. 20—Notwithstanding anything contained in any preceding article, every ship, whether a sailing-ship or a steamship, overtaking any other, shall keep out of the way of the overtaken ship.

"Art. 21—In narrow channels, every steamship shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such ship.

"Art. 22—Where, by the above rules, one of the two ships is to keep out of the way, the othor shall keep her course.

"ART. 23—In obeying and construing these rules, due regard shall be had to all dangers of navigation, and to any special circumstances which may render a departure from the above rules necessary, in order to avoid immediate danger."

—— o ——

Rules and Regulations for the Government of Pilots.

ADOPTED BY THE UNITED STATES BOARD OF SUPERVISING INSPECTORS OF STEAM VESSELS, FEB. 1882 (WITH LATEST AMENDMENTS).

RULE 1. When steamers are approaching each other "head and head," or nearly so, it shall be the duty of each steamer to pass to the right or port side of the other; and the pilot of either steamer may be first in determining to pursue this course, and thereupon shall give, as a signal of his intention, one short and distinct blast of his steam whistle, which the pilot of the other steamer shall answer promptly by a similar blast of his steam whistle, and thereupon such steamers shall pass to the right or port side of each other. But if the course of such steamers is so far on the starboard of each other as not to be considered by pilots as meeting head and head, or nearly so, the pilot so first deciding shall immediately give two short and distinct blasts of his steam whistle, which

the pilot of the other steamer shall answer promptly by two similar blasts of his steam whistle, and they shall pass to the left, or on the starboard side of each other.

NOTE—In the night, steamers will be considered meeting "head and head," so long as both the colored lights of each are in view of the other.

RULE II. When steamers are approaching each other in an oblique direction, they shall pass to the right of each other, as if meeting "head and head," or nearly so, and the signals by whistle shall be given and answered promptly, as in that case specified.

RULE III. If, when steamers are approaching each other, the pilot of either vessel fails to understand the course or intention of the other, whether from signals being given or answered erroneously, or from other causes, the pilot so in doubt shall immediately signify the same by giving several short and rapid blasts of the steam whistle; and if the vessels shall have approached within half a mile of each other, both shall immediately be slowed to a speed barely sufficient for steerage way, until the proper signals are given, answered, and understood, or until the vessels shall have passed each other.

RULE IV. When steamers are running in a fog or thick weather, it shall be the duty of the pilot to cause a long blast of the steam whistle to be sounded at intervals not exceeding one minute.

Steamers, when DRIFTING or at ANCHOR in the fairway of other vessels, in a fog or thick weather, shall *ring their bells* at intervals of not more than two minutes.

RULE V. When a steamer is nearing a short bend or curve in the channel, where, from the heights of the bank or other cause, a steamer approaching from the opposite direction cannot be seen for a distance of half a mile, the pilot of such steamer, when he shall have arrived within half a mile of such curve or bend, shall give a signal by one long blast of the steam whistle, which signal shall be answered by a similar blast, given by the pilot of any approaching steamer that may be within hearing. Should such signal be so answered by a steamer on the farther side of such bend, then the usual signals for meeting and passing shall be immediately given and answered; but if the first alarm signal of such pilot be not answered, he is to consider the channel clear, and govern himself accordingly.

RULE VI. The signals, by the blowing of the steam whistle, shall be given and answered by pilots in compliance with these rules, not only when meeting "head and head," or nearly so, but at all times when passing or meeting at a distance within half a mile of each other, and whether passing to the starboard or port.

RULE VII. Omitted, as it relates solely to "Hell Gate," East River, New York.

RULE VIII. When steamers are running in the same direction, and the pilot of the steamer which is astern shall desire to pass on the right or starboard hand of the steamer ahead, he shall give one short blast of the steam whistle as a signal of such desire and intention, and shall put his helm to port; and the pilot of the steamer ahead shall answer by the same signal; or, if he prefers to keep on his course, he shall give two short and distinct blasts of the steam whistle, and the boat wishing to pass must govern herself accordingly; but the boat ahead shall in no case attempt to cross her bow or crowd upon her course.

NOTE.—The foregoing rules are to be complied with in all cases except when steamers are navigating in a crowded channel, or in the vicinity of wharves. Under such circumstances, steamers must be run and managed with great precaution, sounding the whistle as may be necessary, to guard against collision or other accidents.

Section 4233, *Revised Statutes.*—RULE 24. In constructing and obeying these rules, due regard must be had to all dangers of navigation, and to any special circumstances which may exist in any particular case, rendering a departure from them necessary in order to avoid immediate danger.

RULE IX. All double-ended ferry-boats on lakes and seaboard shall carry a central range of clear, bright, white lights, showing all around the horizon, placed at equal altitudes forward and aft; also such side lights as specified in Sec. 4233, Revised Statutes.

Local Inspectors in districts having ferry-boats shall, whenever the safety of navigation may require, designate for each line of such boats a certain light, white or colored, which shall show all around the horizon, to designate and distinguish such lines from each other, which light shall be carried on a flag-staff amidship, fifteen feet above the white range-lights.

APPENDIX—The manner of fixing the colored lights should be particularly attended to. They will require to be fitted each with a screen of wood or canvas on the inboard side, and close to the light, in order to prevent both being seen at the same moment from any direction but that of right ahead to two points abaft the beam.

This is important, for without the screens any plan of bow lights would be ineffectual, as a means of indicating the direction of steering.

This intimation, with the signals by whistle as provided, is all that is required to enable vessels to pass each other in the darkest night with almost equal safety as in broad day.

If at anchor, all vessels, without distinction, must exhibit a bright white light at least twenty feet above the surface of the water.

RULE. Approved March 1st, 1884. All steam vessels, when engaged in towing during fog or thick weather, shall sound THREE distinct blasts of their steam whistles in quick succession, repeating at intervals not exceeding one minute.

—— o ——

U. S. Life-Saving Service, on the West Coast of the United States.

Instructions to Mariners in Case of Shipwreck.

General Information.

Up the Pacific Coast, the stations are open the year round, but with the exception of Stations Nos. 3 and 7 are not manned, depending upon volunteer effort from the neighboring people in case of shipwreck.

All life-saving and life-boat stations are fully supplied with boats, wreck gun, beach apparatus, restoratives, etc.

Most of the life-saving stations are provided with the International Code of Signals, and vessels can, by opening commnnication, be reported, or obtain the latitude and longitude of the station; information as to the weather probabilities; or if crippled or disabled, a steam tug or revenue cutter will be telegraphed for (where facilities exist) to the nearest port, if requested.

The station crews patrol the beach from two to four miles each side of their stations four times between sunset and sunrise, and if the weather is foggy the patrol is continued through the day.

Each patrolman carries Coston signals. Upon discovering a vessel standing into danger, he ignites one of them, which emits a brilliant red flame of about two minutes' duration, to warn her off; or should the vessel be ashore, to let her crew know that they are discovered, and assistance is at hand.

If the vessel be not discovered by the patrol immediately after striking, rockets or flare-up lights should be burned; or, if the weather be foggy, guns should be fired to attract attention, as the patrolman may be some distance away on the other end of his beat.

Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of stations, especially on any of the sandy coasts where there is not much danger of vessels breaking up immediately, to remain on board until assistance arrives; and under no circumstances should they attempt to land through the surf in their own boats, until the last hope

of assistance from shore has vanished. Often, when comparatively smooth at sea, a dangerous surf is running, which is not perceptible four hundred yards off shore, and the surf, when viewed from a vessel, never appears as dangerous as it is.

The difficulties of rescue by operations from the shore are greatly increased in cases where the anchors are let go *after entering the breakers*, as is frequently done, and the chances of saving life correspondingly lessened.

Instructions.

Rescue with the Life-boat or Surf-boat.

The patrolman, after discovering your vessel ashore, and burning a Coston signal, hastens to his station for assistance. If the use of a boat is practicable, either the large life-boat is launched from its ways in the station, and proceeds to the wreck by water, or the lighter surf-boat is hauled overland to a point opposite the wreck and launched, as circumstances may require.

Upon the boat reaching your vessel, the directions and orders of the keeper (who always commands and steers the boat) should be implicitly obeyed. Any headlong rushing and crowding should be prevented, and the captain of the vessel should remain on board, to preserve order, until every other person has left.

Women, children, helpless persons and passengers should be passed into the boat first.

Goods or baggage will positively not be taken into the boat until all are landed. If any be passed in against the keeper's remonstrance, he is fully authorized to throw it overboard.

Rescue with the Breeches-Buoy or Life-Car.

Should it be inexpedient to use either a life-boat or surf-boat, recourse will be had to the wreck-gun and beach apparatus, for the rescue by the breeches-buoy or the life-car.

A shot with a small line attached will be fired across your vessel.

Get hold of the line as soon as possible, and haul on board until you get a tail-block with a whip or endless line rove through it. This tail-block should be hauled on board as quickly as possible, to prevent the whip drifting off with the set, or fouling with wreckage, etc. Therefore, if you have been driven into the rigging, where but one or two men can work to advantage, cut the shot line and run it through some available block, such as the throat or peak halliard block, or any block which will afford a clear lead, or even between the ratlines, that as many as possible may assist in hauling.

Attached to the tail-board will be a tally-board, with the following directions, in English on one side and French on the other: "Make the tail of the block fast to the lower mast, well up; if the masts are gone, then to the best place you can find. Cast off shot-line, see that the rope in the block runs free, and show signal to the shore."

As soon as your signal is seen, a three-inch hawser will be bent on to the whip, and hauled off to the ship by the life-saving crew.

If circumstances will admit, you can assist the life-saving crew by manning that part of the whip to which the hawser is bent, and hauling with them.

When the end of the hawser is got on board, a tally-board will be found attached, bearing the following directions in English and French: "Make this hawser fast about 2 feet above the tail-block; see all clear, and that the rope in the block runs free, and show signal to the shore." *Take particular care that there are no turns of the whip-line around the hawser before making the hawser fast.*

When the hawser is made fast, the whip cast off from the hawser, and your signal seen by the life-saving crew, they will haul the hawser taut, and by means of the whip will haul off to your ship a breeches-buoy suspended from a traveler-block, or a life-car from rings running on the hawser.

If the breeches-buoy be sent, let one man immediately get into it, thrusting his legs through the breeches. If the life-car is sent, remove the hatch, place as many persons in it as it will hold (four to six), and secure the hatch on the outside by the hatch-bar and hook: signal as before, and the buoy or car will be hauled ashore. This will be repeated until all are landed. On the last trip of the life-car, the hatch must be secured by the inside hatch-bar.

In many instances, two men can be landed in the breeches-buoy at the same time by each putting a leg through a leg of the breeches, and holding on to the lifts of the buoy.

Children, when brought ashore by the buoy, should be in the arms of older persons, or securely lashed to the buoy. Women and children should be landed first.

In signaling as directed in the foregoing instructions, if in the daytime, let one man separate himself from the rest and swing his hat, a handkerchief, or his hand; if at night, the showing of a light and concealing it once or twice will be understood, and like signals will be made from the shore.

Circumstances may arise, owing to the strength of the current or set, or the danger of the wreck breaking up immediately, when it would be impossible to send off the hawser. In such case, a breeches-buoy or

life-car will be hauled off instead by the whip, or sent off to you by the shot-line, and you will be hauled ashore through the surf.

If your vessel is stranded during the night and discovered by the patrolman, which you will know by his burning a brilliant red light, keep a bright lookout for signs of the arrival of the life-saving crew abreast of your vessel.

From one to four hours may intervene between the burning of the light and their arrival, as the patrolman will have to return to his station, perhaps three or four miles distant, and the life-saving crew draw the apparatus or surf-boat through the sand, or over bad roads to where your vessel is stranded.

Lights on the beach will indicate their arrival, and the sound of cannon firing from the shore may be taken as evidence that a line has been fired across your vessel. Therefore, upon hearing the cannon, make strict search aloft, fore and aft, for the shot-line, for it is almost certain to be there. Though the movements of the life-saving crew may not be perceptible to you, owing to the darkness, your ship will be a good mark for the man experienced in the use of the wreck-gun, and the first shot seldom fails.

Recapitulation.

Remain by the wreck until assistance arrives from the shore, unless your vessel shows signs of immediately breaking up.

If not discovered immediately by the patrol, burn rockets, flare-up or other lights; or, if the weather is foggy, fire guns.

Take particular care that there are no turns of the whip-line around the hawser, before making the hawser fast.

Send the women, children, helpless persons and passengers ashore first.

Make yourself thoroughly familiar with these instructions, and remember that on your coolness and strict attention to them will greatly depend the chances of success in bringing you and your people safely to land.

List of Life-Saving Stations on the Pacific Coast.

No. 1. Neah Bay, Washington Territory—On Indiana Reservation.

No. 2. Shoalwater Bay, Washington Territory—Near lighthouse. boat landing.

No. 3. Cape Disappointment, Washington Territory—Baker's Bay.

No. 4. Cape Arago, Oregon—Coos Bay, near lighthouse.

No. 5. Humboldt Bay, California—Near lighthouse.

No. 6. Bolinas Bay, California—Station destroyed by fire.
No. 7. Golden Gate Park, California—On beach, near San Francisco.
No. 8. Point Conception, California—Station not yet built.

———o———

Winds, Calms and Currents,

IN THE EASTERN PORTION OF THE NORTH PACIFIC OCEAN.

Extracts from "The Navigation of the Pacific Ocean," Edition of 1875.

WINDS.

The trade winds of the Pacific Ocean blow, in the Northern Hemisphere, from a general northeasterly direction. They are usually stronger than the N. E. trades of the Atlantic. The parallels between which the regular N. E. trades are most often encountered are as follows:

In January, February and March, between 6° and 25° N.
In April, May and June, between 7° 30′ and 29° N.
In July, August, and September, between 14° 30′ and 28° N.
In October, November, and December, between 9° and 25° N.

The trades do not begin to be well defined within 300 miles of the west coast of America. On coming closer to the coast, variable winds are found, according to the season of the year.

Finally, the N. E. trades of the Pacific attain their greatest force while the sun is in the southern hemisphere, or in other words, from October to March. This remark applies to all trade winds, for they are always stronger when the sun is in the opposite hemisphere; when the sun is in their own hemisphere, they are, on the contrary, always weak, baffling, and often changed to monsoons, blowing from the opposite direction.

ZONES OF GENERAL WESTERLY WINDS.

General westerly winds are encountered at some distance beyond the polar limits of both sets of trades, the trade-wind limit itself following the changes in the sun's declination. Two principal antagonistic currents in the atmosphere, called the *polar* and *tropical* winds, exist in the region of variables. A rotary movement in the atmosphere is produced by the meeting of these currents, causing cyclones or revolving storms

Navigators at the present time are, however, a little too apt to fall into the error of imagining that every storm they encounter is a cyclone. This remark is especially applicable to the Pacific, where real circular

storms, with the exception of the typhoons of the China seas, are very rare.

In either hemisphere the wind from the direction of the adjacent pole is cold, dry, and squally, while the wind from the equator, or *tropical* wind, is warm, damp, and rainy. Thus, when the wind is blowing from S. W. in the *northern hemisphere*, and the sky shows signs of clearing to the N. W. or N., while at the same time the thermometer falls, and the deck, sails and rigging dry rapidly, it follows that the wind will soon come out from N. W. and N. These signs are verified by a rise in the barometer.

PREVAILING WINDS ON THE COAST OF GUATEMALA, MEXICO, AND CALIFORNIA.

From the Gulf of Panama to Cape Blanco (about 10° N.,) the winds are variable, but prevailing between S. W. and N. E., passing around by the way of S. and E. in January, February, and March. The two principal directions are S. and S. E. The winds are, as a rule, steady the rest of the year; they prevail from S. W. to S. E., particularly from the southward.

From Cape Blanco to Cape Corrientes (about 20° 30′ N.) the prevailing winds in January, February, and March are, first, those from N. E., varying from N. to N. W., between Cape Blanco and Acapulco; second, those from N. W. varying to N. and N. E., between Acapulco and Cape Corrientes. The first three months of the year correspond to the *dry season;* at this time the winds often blow violently from N. N. E. to N. E. In April, May, and June calms are continuous, and the breezes are light and variable. From Cape Blanco to Acapulco the wind prevails from S. and E., and from Acapulco to Cape Corrientes, from N. E. to N. and N. W. July, August, and September are the bad season, which actually lasts from May to October. S. E. and E. winds prevail as far as 15° N. Near Acapulco, and continuing as far as Cape Corrientes, variable winds blow, principally from N. W., but also often from S. W., S., and particularly from S. E., E. S. E., and E. At this season the winds from S. S. W. to S. S. E. bring heavy rains and tornadoes, followed by calms all along the coast. Frequently the S. W. winds are violent; sometimes the heavy squalls from this direction at Acapulco, San Blas, etc., render it dangerous for vessels to come to anchor, or remain any length of time, until December.

In October, November, and December prevailing winds are found from N. E., N., and N. W., to the northward of Cape Blanco; these often haul to the westward, between the Gulf of Tehuantepec and Acapulco; afterward, between Acapulco and Cape Corrientes, the prevailing winds are

found to be from N. E., N., and especially N. W. The fine season can be considered as commencing in December.

Between Cape Corrientes and Cape Mendocino (about 40° 30′ N.) moderate weather may be counted upon. The winds generally prevail from N. W. The southwesterly winds bring rain, especially in November. In January, February, and March the prevalent winds are from N. to N. W. and W., with a few southerly breezes between Cape Corrientes and San Lucas. From Cape San Lucas to about 30° N., they vary from N. E. to N. and from N. W. to S. W., the greater part coming from N. W. and N. Farther to the northward, from the parallel of 30 degrees to Cape Mendocino, variable breezes from all points of the compass may be encountered, especially from N. W., N., and N. E. Between Corrientes and San Lucas the winds in April, May, and June are from N. W., varying to W. and S. W.; from San Lucas to 30 degrees N., from N. W., varying to N. N. W. and N.; while from 30 degrees N. to Cape Mendocino they still blow from N. W., though varying from N. and N. N. E. In July, August, and September the winds between Corrientes and San Lucas are from N. W., shifting very often to W. and S. W.; from San Lucas to 30° N. they also prevail from N. W., varying to N. and N. E. Finally, from 30° N. to Mendocino they come from N. N. W., frequently passing to N. and N. N. E. In October, November, and December the prevalent winds are from N. W., varying to N. N. W. and N., between Corrientes and San Lucas, and also extending to 30 degrees N.

Beyond this parallel they are dominant from N. N. W., N., and N. E.; but during this season they often blow from some point between W. N. W. and S. S. W., in which case they are accompanied by rain. During the whole year thick fogs are frequent to the northward of 30° N., extending to the 45th parallel. They constitute the principal danger to navigation, and to making a land-fall on the coast of California.

North of Cape Mendocino the winds are variable, and present a certain analogy to those which prevail off the coasts of England and Ireland. They are, however, prevalent from N. N. W., from Cape Mendocino to about 50° N., except in December, January, February and March, when they blow oftenest from S. E. to S. W. During this winter season the weather is bad, with rain and strong winds, which are especially to be feared when they *back* from the W. S. W. toward the S. W., S. and S. E. Winds from the W. N. W. and N. are dry; those from the S. W. and S. E. foggy and damp. The strongest squalls seem to come from between S. W. and S. E. During all the year, fogs are to be expected as far to the northward as 45° N.; they are less frequent in winter than during the rest of the year.

CALMS.

The existence is proved of a clearly defined region of calms, lying between the two sets of trades in the eastern part of the Pacific. These calms are termed equatorial. It is also known that the zone in which the navigator is most exposed to detention from calms takes the form of a wedge, the base resting on the coasts of Guatemala and Mexico, between 5° and 25° N., and the apex extending to the westward for a distance varying according to the season.

Thus, in January, February and March, calms are common on the western coast of America, from the equator to 20° N. Vessels making passage to the northward, east of 110° W., will find a calm belt about 20° wide, where they will be liable to from 4 to 6 per cent. of calms.

Between 110° and 130° W. the bolt is only 10° wide; here there are only 4 per cent. calm chances. Finally, west of 130° W. the calm belt may be said to cease, vessels usually passing from one set of trades to the other without being appreciably detained.

In April, May and June the calm belt extends from the 120th meridian to the coast of America, causing navigation on the Mexican Coast, from the Gulf of Tehuantepec to Cape Corrientes, to be almost impossible for sailing vessels. The calms in this locality often last for several successive weeks. Well defined equatorial calms are not encountered west of 120° W., or, at the farthest, 130° W.

The equatorial calms are of greater duration during the months of July, August and September, and prevail north of 10° N. They extend from the coast of Mexico to 140° W. East of 130° W. they extend as far north as the 30th parallel; between 130° and 140° W. the calm belt is only 10° broad, while west of 140° calms are no longer common.

In October, November and December a calm belt extends from the Mexican coast to 120° W., and from 10° to 20° or 25° N. Farther to the westward, several calm regions exist, but they have none of the attributes of genuine *calm-belts*. Equatorial calms also exist in the West Pacific, especially between the equator and 10° S.; in the Central Pacific, however, though the numerous groups of islands interrupt the trades, calms rarely prevail to any great extent.

Tropical calms are those which prevail on the polar borders of the trades. The calms of the Tropic of Cancer are only well defined in the eastern part of the Pacific, and during the months comprised between April and September. They are common between the parallels of 30° and 40° N. East of Japan, however, and between the same parallels, the calms are of greater duration, except during October, November and December.

CURRENTS.

On the coast of California, from about 50° N. to the mouth of the Gulf of California, 23° N., a cold current, 200 or 300 miles wide, flows with a mean speed of seven-tenths of a knot, being generally stronger near the land than at sea.

Usually, it follows the trend of the land, that is, nearly S. S. E., as far as Point Conception (S. of Monterey), when the current begins to bend towards S. S. W., and then to W. S. W., off Capes San Blas and San Lucas. The temperature off Monterey is not more than 55°.5 or 57°, and only 59° at 30° N.

On the coast of Mexico, from Cape Corrientes (20° N.) to Cape Blanco (Gulf of Nicoya), there are alternate currents, extending over a space of more than 300 miles in width, which appear to be produced by the prevailing winds.

During the dry season, January, February and March, the currents generally set towards S. E. During the rainy season, from May to October—especially in July, August and September—the currents set to N. W., particularly from Cocos Island and the Gulf of Nicoya to the parallel of 15°.

—o—

Hurricanes.

(COMPILED.)

Hurricanes are caused by a portion of the atmosphere becoming violently heated, and thereby acquiring a circular motion about a center or focus, and around this focus the wind rushes with great violence. The meteor has also a progressive motion, at a rate varying from twelve to thirty miles per hour. The diameters of these meteors vary from one hundred to three hundred miles. The wind blows with the greatest fury near the center, and there, also, the shifts of wind are most rapid; towards the circumference the wind has less force, and the time between the changes is of greater length.

The places most subject to hurricanes are the northern limits of the N. E. trade-wind, to the eastward of the meridian of the West India Islands, in the N. Atlantic Ocean, and the southern limit of the S. E. trades, to the eastward of the meridian of the Island of Mauritius, in the S. Atlantic. Hurricanes also occur in the Bay of Bengal and its vicinity, at the change of the monsoons in May and October.

Hurricanes in the North Atlantic Ocean commence on the northern limits of the N. E. trade-wind, in August and September, and travelling

to the westward, visit the West India Islands, and thence pursue a N. E. course, parallel with the Gulf Stream, along the coast of the United States of North Ameriea. The diameter of this meteor varies from one hundred to two hundred miles, and its progress is at the rate of about seventeen miles an hour. But the distinctive featurc of this hurricane is, that it blows from *right to left*, around the focus or center, it being a calm space.

The Typhoons in the China Sea seem to differ in nothing but name from the hurricane of the well frequented seas of the Western Atlantic. They rotate in the same manner (from right to left). They appear to originate in the same latitude, and to travel in the same direction—at first northwestward, till they arrive at the northern limit of the trade-wind, and then turning northeastward, parallel with the coast of China. These storms occur during both Monsoons, but are more violent during the months of June and July.

The S. W. Monsoon commences about the latter end of April, and continues until October, with much rain and squally weather.

Typhoens occur most frequently during this Monsoon. The N. E. Monsoon blows the balance of the year, with generally fine, dry weather. The most terrific hurricanes frequently occur about the *change* of the Monsoons.

Hurricanes in the South Atlantic commence near the southern limits of the S. E. trades, to the eastward of the Island of Mauritius, and pursue a course to the westward. These are generally looked for during the months of February or March. The distinctive feature of these hurricanes is, that they rotate about a focus from *left to right*, contrary to the action of similar winds in the northern hemisphere. Every ship navigating seas where hurricanes are likely to occur should be provided with a *good* barometer and sypiesometer, and strict attention should be paid to their movements. When the barometer falls to 29.50, the weather threatening, and the clouds of a bluish, gloomy appearance, the ship is on the verge of a storm circle, and the focus may be 150 miles distant. As the focus is approached, the barometer falls to 29.20 inches one hundred miles distant, 28.40 at about fifty miles, and 28 at thirty miles. Near the focus it is sometimes as low as 27 inches.

To Shipmasters.—I offer you my services in rating Chronometers by Transit Observations, or for the repairing of any instrument. I have been practically brought up to my business, and guarantee my work as first-class. No runners employed. Thomas Tennent,
No. 18 Market St., near Ferry Landing.

Rules to Avoid Hurricanes.

The vortex of a Typhoon or Hurricane may be avoided, and the ship placed beyond its reach, by the following rule:

Place your back to the wind; then if the vessel be in *North* latitude, the vortex of the hurricane will be on your *left hand;* but if in *South* latitude, it will be on your *right;* in both cases at right angles from the direction in which you are looking.

In North Latitude.

Hurricane Wind.	Bearing of Focus.	When the path is to the W. N. W.	When the Path is to the N. E.
East....	South...	Heave to on starboard tack.	Run before the wind until it has shifted to W. from N., and then heave to on port tack.
N. E....	S. E....	Heave to on starboard tack or run before the wind until it has shifted to N. W., then heave to on port tack.	Heave to on port tack.
North...	East....	Run before the wind until it has shifted to N. W., or W. N. W., then heave to on port tack.	If desirable to heave to, do so on port tack.
N. W...	N. E....	Heave to on port tack, but in this case the center will pass very close; better run at discretion and then heave to on port tack.	Here it makes no difference on what tack, as the center moves at right angles from you.
West....	North...	Heave to on port tack.	Heave to on starboard tack.
S. W....	N. W...	Heave to on port tack.	Heave to on starboard tack.
South...	West....	Heave to on starboard tack.	Heave to on starboard tack.
S. E.....	S. W....	Heave to on starboard tack.	Here your position is right in front of the path; run to the N. W. until it has shifted to the N. of E., then heave to on port tack.

In South Latitude.

Hurricane Wind.	Bearing of Focus.	When the Path is to the W. S. W.	When the Path is to the S. E.
West....	South ...	Heave to on starboard tack.	Heave to on port tack.
N. W...	S. W....	Heave to on starboard tack.	Heave to on port tack.
North...	West...	Heave to on port tack.	Heave to on port tack.
N. E....	N. W...	Heave to on port tack.	Run before the wind S. W. until it has shifted to E. S. E. or S. E., then heave to on starboard tack.
East....	North...	Heave to on port tack.	Heave to on starboard tack.
S. E.....	N. E....	You may heave to on port tack, but in this case the center will pass very close by; it is better to risk running before the wind N. W., until the wind has shifted to S. W. or W. S W., then heave to on starboard tack.	Heave to on starboard tack.
South ...	East	Run before the wind to the Northward, or else the center will come too near your vessel: when the wind has shifted to S. W. or W. S.W. heave to on starboard tack.	Heave to on starboard tack.
S. W....	S. E....	Heave to on starboard tack.	Here no shift of wind will take place, as the focus moves away at right angles from the ship.

TABLE SHOWING THE DIFFERENT MONTHS IN THE YEAR IN WHICH HURRICANES AND CYCLONES HAVE BEEN RECORDED IN VARIOUS REGIONS.

LOCALITY.	JAN...	FEB...	MCH...	APR...	MAY..	JUNE.	JULY..	AUG..	SEPT..	OCT...	NOV...	DEC...
North Atlantic and West Indies.....	5	7	11	6	5	10	42	96	80	69	17	7
Southern Indian Ocean, and Mauritius.	9	15	15	8	4	..	..	..	1	1	4	6
Northern Indian Ocean; Bay of Bengal, N. E. Monsoon.....	1	..	3	..	..	..	..	..	..	12	7	6
S. W. Monsoon.....	..	..	..	6	16	4	1	2	1	..	..	.
Arabian Sea and Bombay, N. E. Monsoon.....	1	1	1	..	..	..	..	..	8	12	9	5
S. W. Monsoon.....	..	..	..	5	9	2	4	5	..	..	..	..
China Sea and North Pacific, Western part.....	1	..	..	..	2	2	12	5	18	14	12	1
Java Sea and Northwest Coast of Australia.....	3	5	1	1	2	..	..	..	..	..	..	2

The Thermometer.

Its Uses.

Farenheit's Thermometer is used on board ships, for the purpose of ascertaining the temperature of the ocean at the surface, and of the air on the ocean.

The Thermometer is a most useful instrument to give warning of the ship's approach to ice in thick, foggy weather. This is known by plunging the Thermometer into a bucket of water, drawn from alongside at regular intervals during the day, and noting the readings.

In a locality where ice may be expected to be fallen in with, should the mercury in the tube keep sinking, we may conclude that the ship is approaching ice. If it be in the winter season, and the Thermometer has fallen to 34 degrees, she will then be only half a mile from the ice. If in the summer, and the Thermometer has fallen to 42 degrees, she will then be the same distance off. On a nearer approach, the mercury falls still lower. When the ship has passed the ice, the thermometer again rises. The temperature of the ocean is higher in deep water than in shoal water, near the land or on banks. On approaching land, the Thermometer falls from two to six degrees, except with deep water near a high, bold shore, when the change is not so apparent. The temperature, as indicated by the Thermometer, is also used in connection with the barometric indications in judging the weather.

—o—

The Barometer.

Barometric Indications.

On board ships, the Barometer is relied on for the purpose of foretelling the state of the weather. Confined in a frame is a glass tube containing a column of mercury, which is acted upon by the pressure of the atmosphere; to the frame is attached a scale marked in inches, and a sliding vernier, the top of which, being set at the height of the mercurial column, gives the measurement in inches and hundredth parts of an inch. In north latitude it stands highest with N. E. winds and lowest with S. W. In south latitude it stands highest with S. E. winds and lowest with N. W. About the commencement of a storm, in north latitude, from S. W., with rain, the Barometer falls, and continues to fall as the storm increases; when it stops and begins to rise, the rain will soon cease, and a shift of wind to the north may be looked for; it may,

however, continue to blow hard until the Barometer rises to thirty inches.

In south latitude N. W. winds bring rain, with a falling barometer, but it rises with S. winds. It should always be remembered that the state of the air, as indicated by the Barometer, *foretells coming weather* rather than shows the present; this invaluable fact is often overlooked.

The longer the time between the barometric signs and the change foretold by them, the longer such altered weather will last; and on the contrary, the less the time between the warning and the change, the shorter will be the continuance of such foretold weather.

The following remarks apply more particularly to northern latitudes.

The Barometer and Thermometer should be noticed in connection. If the Barometer has been about its ordinary height, say nearly thirty inches (at the sea-level), and is steady or rising, while the Thermometer *falls*, and dampness becomes less, N. W., N., or N. E. winds may be expected. On the contrary, if a fall takes place with a *rising* Thermometer and increased dampness, wind and rain will surely follow from the S. E. S., or S. W. A fall of the Barometer with a low Thermometer foretells snow in high latitudes. Exceptions to this rule occur when a N. E. wind (with rain, hail or snow) is impending, before which the Barometer often rises on account of the coming wind alone. This often deceives persons who expect fine weather from a "rising glass." When the Barometer is rather below its ordinary height, say down to 29.5 inches at sea-level, a rise foretells less wind, or a change in its direction towards the northward, or less wet weather; but when it has been very low, say 29 inches, the first rising usually precedes or indicates *strong* winds, and at times heavy squalls from N. W., N., or N. E.; after which violence a gradually rising glass foretells an improvement in the weather, if the Thermometer *falls;* but if the warmth continue, the wind will back around more southerly, or southwesterly, and blow, especially if the Barometer rises suddenly. The most dangerous shifts of wind, or the heaviest northerly gales, happen soon after the Barometer rises from a low point, or at a later period if the wind veers gradually. Indications of approaching changes of weather, and the direction of winds, are shown less by the height of the Barometer than by its falling or rising. Nevertheless, a height of more than thirty (30) inches is indicative of fine weather and moderate winds, except from east to north occasionally. The Barometer is said to be falling when the mercury in the tube is sinking, at which time its upper surface is somewhet concave or hollow, or in Aneroids when the hand moves to the left. The Barometer is rising when the mercurial column is lengthening, the upper surface being then convex or round, or when the hand in the Aneroid moves from left to right. A *rapid rise*

of the Barometer always indicates unsettled weather ; a slow movement the contrary, as likewise a steady Barometer, which, when continued with dryness of air, foretells very fine weather. A *rapid* and *considerable fall* foretells stormy weather, rain or snow. *Alternate rising and falling* (sometimes called pumping) indicates very threatening and unsettled stormy weather. The greatest depressions of the Barometer are with gales from S. E., S., or S. W. The greatest elevations with wind from N. W., N., or N. E., or with calm. Though the Barometer generally falls with southerly and rises with northerly winds, the contrary sometimes occurs, in which case the southerly wind is usually very violent, and accompanied by rain or hail, perhaps with lightning. When the Barometer sinks considerably, much wind, rain or snow will follow, with or without lightning. The wind will be from the northward, if the Thermometer is high (for the season of the year). A *sudden fall* of the Barometer, with a present westerly wind, will be followed by a violent gale from N. W., N., or N. E. If the gale sets in from E. or S. E., and the wind veers by the S., the Barometer will continue falling until the wind is near a marked change, when a lull *may* occur, after which the gale will be renewed, perhaps suddenly and violently, and the veering of the wind towards the N. W., N., or N. E. will be indicated by the rising of the Barometer and the falling of the Thermometer.

The Coast Survey reports that N. W. winds on the North Pacific Coast are not usually predicted by the Barometer, but from the S. E. almost invariably, the mercury falling one inch from the usual height of thirty inches.

The Aneroid Barometer.

The indications given by the Aneroid are the same, in fact, as those by the mercurial column. Its action is governed by atmospheric pressure upon a thin metallic case hermetically sealed, in which has been created a vacuum. The contraction and expansion of this case act upon a metallic spring, which, connected with certain works, regulates the movements of the hand. The inches and hundredths are read off from the circular scale, in the same manner as those of the mecurial Barometer, the hand indicating the figures. This instrument is very sensitive and exact, and is a safe guide at times, when, by the violent motion of the vessel, the plunging of the mecurial column renders the marine Barometer comparatively useless.

The Chronometer.

The Chronometer is a superior kind of watch, and its advantages for measuring time more accurately are derived from its excellent construction, reduced friction from its peculiar make, and being supplied with a compensation balance, which, when properly adjusted, counteracts the effect of temperature. The reputation of the maker is generally the only guarantee the purchaser can have for the satisfactory performance of the instrument.

The best position on shipboard for the chronometer is as near the center of motion, and as much removed from liability to shocks and change of temperature, as possible. It should be placed in a case firmly secured, resting upon and surrounded by curled hair or other elastic material.

Magnetism affects the rates of chronometers. It is therefore essential that nothing magnetic be placed near them, and they should remain in whatever position they are first placed ; the magnetic action of the iron on board vessels is sometimes apt to affect the balance. The principal cause, however, of alteration in the rates of chronometers is change of temperature ; to obviate this some surveying vessels keep the temperature of the chronometer room equable by means of lamps. The rates do not always change immediately, but sometimes at a considerable interval after the change of climate.

If there is but one chronometer on board it should never be taken from its place in the cabin for the purpose of marking time for observations. A watch with a second-hand may be used to mark the time, being compared with the chronometer before and after the observation. If there are more than one, the one moved should be compared before and after moving with another, to ascertain whether its rate has been disturbed. It has been found by experience that the motion of a chronometer is frequently accelerated after being received on board, whereby a gaining rate will be increased and a losing one diminished. This effect has been ascribed to the magnetic action exerted by the iron in the vessel on the inner rim of the balance, which is made of steel. When the rate is accelerated, the longitude resulting from observations made with it will be to the westward of the true longitude ; when retarded, to the eastward. The stay should always be carefully set before moving a chronometer, as they are often injured by neglect of this precaution. It should be wound up at a regular hour each morning, so that the same parts may undergo the same constant action. The rate generally changes after a chronometer has been allowed to run down. After winding, always look at the face to see that it has not stopped, and also at the index, to be certain that it is wound up ; for it is not uncommon for careless or in-

experienced persons to turn the rachet-key the wrong way, leaving the chronometer unwound. When a chronometer is wound after running down, it is set going by giving it a small horizontal rotary motion—first taking the precaution to set the stay. Chronometers are sometimes liable to jump one or two seconds on the daily rate without any apparent cause, (but generally from a defect in the adjustment of the escapement,) and then resume their former rate in a few days; they should be compared or rated at every port where reliable opportunity may offer.

—— o ——

Of the Gain and Loss of Time in Circumnavigating the Globe.

A ship sailing east or west from any meridian, and returning to that meridian after having circumnavigated the globe, will be found to have gained or lost twenty-four hours.

Thus, sailing west from the meridian of Greenwich, when the ship has made 15 degrees of longitude, the mean time will be found to be one hour behind that of the Greenwich chronometer time; continuing her course west until she reaches the longitude of 180 degrees west, she will have lost twelve hours; still proceeding westward, she is now in east longitude, and the longitude is decreasing; when she again arrives at the meridian of Greenwich she will be twenty-four hours behind time, or have lost one entire day. Hence, when crossing the meridian of 180 degrees west, one day must be discarded. Thus: should we pass 180 degrees west on Sunday, January 5th, the next day must be called Tuesday, January the 7th.

When sailing east under like circumstances, when 15 degrees of longitude have been made, the mean time of ship will be one hour a head of Greenwich chronometer time. When arrived at 180 degrees east, the time at ship will be twelve hours in advance of the chronometer time. Passing the meridian of 180 degrees east into west longitude, and continuing eastward, we decrease our longitude, until having arrived again at the meridian of Greenwich, we find we have gained twenty-four hours on the voyage.

Hence, when coming to 180 degrees east, and crossing to west longitude, one day must be counted twice. Thus: should we pass a meridian of 180 degrees east on Sunday, January 5th, the next day must likewise be called Sunday, January 5th.

Distance, by Four-point Bearing.

This method recommends itself to favor, from its extreme simplicity and comparative accuracy. It is as follows: When a light or other fixed object bears by compass four points (45 deg.) from the course, note the exact time by watch, and again do so when it bears on the beam, or 90 deg. from the course. The distance run by ship in the interval is the distance of the object when abeam. For example: Let a vessel be steering north, by compass, at a rate of 8 knots an hour; at 9 o'clock A. M. a lighthouse is observed to bear N. E., and at 9.30 A. M. it bears east; in the interval of half on hour the ship ran 4 miles, which, accordingly, is her distance from the lighthouse when abeam.

It sometimes happens that a light or other fixed object is not visible until nearly abeam; in such cases the four-point method is not available, but the approximate distance of the object can be found, as follows: Note the time carefully when it bears exactly 1¼ points before the beam, and again when it has the same bearing abaft the beam. Twice the distance sailed in the interval is very nearly the distance of the object when it bore exactly on the beam.

—o—

The Greenwich Date.

Much needless confusion has been produced by the introduction into treatises on Navigation of three distinct modes of reckoning time, viz: Sea, Civil and Astronomical Account. The Civil Day begins at midnight; the first twelve hours are marked A. M., the last twelve hours, P. M. The Astronomical day begins at noon, twelve hours after the Civil day commences; the hours are numbered from one to twenty-four in numerical succession. The use of Sea Account, being productive of much inconvenience, has been abandoned in the U. S. Navy. All the calculations of the Nautical Almanac are adapted to Astronomical time at Greenwich; it consequently becomes necessary to know the Greenwich date (Greenwich date is adopted in expressing both day and hour), or Astronomical day and hour at Greenwich when the observation was taken. The Greenwich date is always given in mean time, except the contrary is expressed.

The rule for turning Civil into Astronomical time is: "If the Civil time be A. M., take one from the date and add twelve to the hours, and the result will be the Astronomical time wanted; If the Civil time is marked P. M., discard the designation P. M., and the Astronomical time

is had without further change." Thus, January 2d, four hours, A. M., Civil time is January 1st, sixteen hours, Astronomical day; and January 2d, four hours, P. M., Civil day, is January 2d, four hours, Astronomical day.

TO FIND THE GREENWICH DATE WITHOUT THE CHRONOMETER.

In west longitude find the Astronomical date, and add to it the longitude in time; if the sum exceed 24 hours, deduct 24 hours, and reckon the time the next day.

Example 1.

Required the Greenwich date, June 1st, 9 h. A. M., Civil time, in longitude 76 deg. 30 min. W.

	H. M.	
Civil time, June 1st	09 00	A. M.
Add	12 00	
Astronomical date, May 31st	21 00	
Longitude 76 deg. 30 min. W. in time, add	5 06	
	26 06	
Subtract	24 00	
Gives Greenwich date, June 1st	2 06	

Example 2.

Required Greenwich date, June 1st, 9 h. P. M., Civil time, in longitude 76 deg. 30 min. W.

In this case, P. M. Civil date is H. M.

Astronomical date June 1st	9 00
Longitude 76 deg. 30 min. W. in time, add	5 06
Gives Greenwich date, June 1st	14 06

In East longitude, from the Astronomical date subtract the longitude in time; if the longitude in time be greater than the Astronomical date, add 24 hours to the latter, and reckon it the preceding day.

Example 1.

Required Greenwich date, May 15th, 7 A. M., Civil time, in longitude 67 deg. 30 min. E.

	H. M.
Astronomical date is May 14th	19 00
Longitude 67 deg. 30 min. E. in time, subtract	4 30
Gives Greenwich date, May 14th	14 30

Example 2.

Required Greenwich date, October 1st, 3 hours, 45 minutes P. M., Civil time, longitude 110 deg. E.

	H. M.
Astronomical date, October 1st	3 45
Add	24 00
	27 45
Longitude 110 deg. E. in time, subtract	7 20
Gives Greenwich date, September 30	20 25

When it is Noon at the Place.—In West longitude, the Greenwich date is the longitude in time; in East longitude, subtract the longitude in time from twenty-four hours; the remainder is the Greenwich date the preceding day.

The Greenwich date, by the methods which have been given, will show whether the chronometer is A. M. or P. M., viz:

If the Greenwich date (or Astronomical time) be less than twelve hours, the chronometer shows P. M.; but if more than twelve hours, the excess is so much past midnight, or A. M.

—o—

Practical Rules

To Adjust a Sextant, Octant, or Quadrant.

In each of these instruments the index and horizon glasses must be perpendicular to the plane of the instrument, and when zero or 0° on the vernier is set to coincide with zero on the arch, the horizon glass must be parallel with the index glass.

To Adjust the Index Glass.—Set the index limb near the middle of the arch, then hold the instrument in such position that the eye can observe in the center of the index glass the *direct* arch, and also its *reflected* image; if these form one continuous line, the index glass is correct; if not, the adjustment is to be made by means of the screws at the back of the index glass frame, bringing it forward or backward as required.

To Adjust the Horizon Glass.—This adjustment is generally made by means of the natural horizon, but a better method is to set the index limb so that zero on the vernier will accurately coincide with zero on the arch, and clamp it in that position; then, after interposing the proper sun screens, look directly at the sun, so that one-half of the sun is seen in the *silvered* portion of the horizon glass, and the other half in the *un-*

silvered portion. If these two halves form one round image, this glass is correct; but if not, the adjustment must be made by the tangent or screws attached to the horizon glass frame for that purpose.

To Adjust the Telescope of a Sextant.—In measuring angular distances with a sextant, the line of sight of the telescope must be parallel to the plane of the instrument; this is determined by measuring the angular distance not less then 90°—between the sun and moon, or any other two objects. In making this measurement the telescope having cross-wires is used, these wires being first brought parallel to the plane of the instrument by turning the eye-tube around. If the two objects are in exact contact when observed on the inner wire, and also when observed on the outer wire, the telescope is correct; if not, the adjustment is made by means of the two small screws in the face of the ring into which the telescope is screwed.

—o—

To Find the Sun's Declination from the Nautical Almanac.

Find the Greenwich date, and take from the "Nautical Almanac" the declination for apparent noon and the hourly difference. If the declination is increasing, mark the difference + (add); if decreasing,— (subtract); reduce the time to hours and decimal parts of an hour, and multiply the hourly difference by it; reduce the product to minutes and seconds, and add it to or subtract it from the declination at noon, as indicated by the sign.

Example 1.

Required the Sun's declination, at noon, November 6th, 1889, in longitude 153 deg. 45 min. West.

	H.	M.
Local Astronomical date is November 6th	00	00
Longitude 153 deg. 45 min. West, in time, add	10	15
Greenwich date is November 6th	10	15

		D.	M.	S.
Hourly difference	44.7	Sun's declination	16	08	05
Hours, Greenwich time and decimal parts	10.252	Declination increasing, add		7	38
	2235	Required declination	16	15	43
	894				
	447				
	60)458.175				
	7′ 38″.2				

Example 2.

Required the Sun's declination, January 9th, 1889, at 9 A. M., in longitude 97 deg. 8 min. East.

	H.	M.
Local Astronomieal date is January 8th	21	00
Longitude 97 deg. 8 min. East, in time, subtract	6	30
Greenwich date is January 8th	14	30

	S.		D.	M.	S.
Hourly difference	21.9	Sun's declination	22	02	04
Hours, Greenwich time and decimal parts	14.5	Declination decreasing, subtract		5	17
	1095	Required declination	21	56	47
	876				
	219				
	60)317.55				
	5′ 17″				

NOTE.—In these examples, as in all other cases, the hourly difference being in seconds, with a decimal fraction, renders it necessary that, when multiplied by the hours and minutes of time, these minutes should also be reduced to decimals of an hour. Vulgar fractions are turned into decimal fractions by dividing the numerator by the denominator, thus: 15 minutes being 15 sixtieths of an hour, 15 divided by 60 gives .25 for the decimal fraction; and again, in like manner, 6 h. 30 m. is equal to 6.5.

—— o ——

The Equation of Time.

Find the Greenwich date; take the equation of time and hourly differences from the "Nautical Almanac," reduce the time to hours and decimal parts, and multiply the hourly difference by it; add the product, if the equation is *increasing*; subtract, if *decreasing*.

Required, Equation of time corresponding to date and longitude given in Example 1, for finding the sun's declination,

	S.		M.	S.
Hourly difference	0.12	Equation of time	16	14.3
Hours, Greenwich time, and decimal parts	10.25	Equation decreasing, subtract correction		1.2
	60	Equation required	16	13.1
	24	To be subtracted from apparent time.		
	12			
	1,2300			

Required, Equation of time corresponding to date and longitude given in Example 2, for finding the sun's declination :

Greenwich date, January 8th, 1889, is.....14 30

	s.		m.	s.
Hourly difference.....	1.05	Equation of time.....7		08.6
Hours, Greenwich time, and decimal parts.....	14.5	Equation increasing, add correction.....		15.2
	525	Equation required.....7		23.8
	420	To be added to apparent time.		
	105			
	15.225			

For finding the Declination and Equation, on the west coast of the United States, it will be sufficiently close for all practical purposes to apply *one-third* of the difference between the required day and the following one, which will be the correction for 120 degrees of West longitude. If greater accuracy is required, the correction for the remaining degrees, will be made in the usual way.

— o —

To Find the Longitude by Chronometer at Noon, from Equal Altitudes of the Sun.

A. M. —Ob erve an altitude of the sun, about thirty minutes from noon ; note the altitude and time of observation by chronometer.

P. M. —Clamp the index of the sextant or quadrant at the same altitude as observed before noon, and when the sun falls to it, again note the time by chronometer.

Add together these two chronometer times, and find half their sum ; to this half sum apply the chronometer error as usual ; the result will be the mean Greenwich time ; to this Greenwich time apply the equation of time corrected the contrary way, as indicated in the "Nautical Almanac," and the product will be the Greenwich apparent time, which in West longitude is the longitude in time at apparent noon, corresponding to the time at which the meridian observation is taken for latitude.

Example.

April 20th, 1889 (Civil day). Before noon the altitude of the Sun's lower limb was observed to be 67 degrees 58 minutes ; time by chronometer, 8h. 19m. 15s. When the sun fell to the same altitude after noon

the time by the chronometer was 9h. 23m. 21s.—chronometer slow, 2m. 15s. Required the longitude.

	H.	M.	S.
Approximate Greenwich date, April 20	9	00	
A. M. Time by Chronom.	8	19	15
P. M. Time by Chronom.	9	23	21
Sum	17	42	36
Half Sum	8	51	18
Chronometer slow, add	2	15	
Greenwich Mean Time	8	53	33
Equation of time directed subtract, hence add, being applied to mean time	1	17	
Greenwich apparent time at apparent noon at ship and is the longitude in time	8	54	50

	M.	S.
Hourly diff. of Equation	0.	53
Greenwich hours	9	
Correction of Equation	4.	77
Equation Naut. Almanac	1	12.5
Equal increasing, add	4.	8
Corrected Equation	1	17.3

=133° 42′ 30″ West longitude.

In East longitude, the difference between apparent noon at the ship and the Greenwich time by chronometer, reduced to apparent time, is the longitude in time.

Example.

April 4th, 1889. Before noon the altitude of the Sun's lower limb was observed to be 86 degrees, 10 minutes; time by chronometer, 1h. 50m. 0s. When the sun fell to the same altitude after noon, the time by chronometer was 2h. 16m. 0s. Chronometer fast, 1m. 10s. Required the longitude.

	H.	M.	S.
Approximate Greenwich date, April 3d	14	00	
A. M. Time by Chronom.	1	50	00
P. M. Time by Chronom.	2	16	00
Sum	4	06	00
Half Sum	2	03	00
Chron. fast, subtract	1	10	
Greenwich Mean Time	2	01	50
Equation of time directed add, hence subtract, being applied to mean time	3	04	
Greenwich appar't time.	1	58	46
Apparent noon at ship	12	00	00
Diff. in long., in time	10	01	14

	S.
Hourly diff. of Equation	0.74
Greenwich hours	14
	2.96
	7.4
Correction of Equation	10.36

	M.	S.
Equation Naut. Almanac	3	14.4
Equa. decreas'g, subtract		10.4
Corrected Equation	3	04.0

=150° 17′ 20″ East longitude.

NOTE.—When a ship is making much northing or southing in the interval between the altitudes, if sailing *toward* the sun, after having noted the chronometer time, *increase* the A. M. altitude, by advancing the index of the instrument equal to the difference of latitude made in the interval; sailing *from* the sun, *decrease* the A. M. altitude by moving the index back, equal to the difference of latitude made in the interval, noting the time for the same altitude P. M. without further correction.

———o———

To Find the Apparent Time and Longitude by Chronometer at Sunrise and Sunset.

Observe with a spy-glass the instant the upper or lower limb of the sun touches the horizon, and note the time by the chronometer.

Bring the latitude forward to the time of observation, correct the declination, and find the polar distance, as in ordinary cases.

When the lower limb is observed, take the difference between the sun's semi-diameter (N. A.) and the refraction (Table 20, Bowditch, New Edition) for 00 degrees, 00 minutes altitude, from which subtract the parallax for 00 degrees, 00 minutes altitude. (Table 16, Bowditch.) To this add the dip of the horizon (Table 14, Bowditch) corresponding to the height of the eye above the sea level. The result constitutes a correction, usually about 22 min., which must be subtracted from the sum of the latitude and polar distance, and added to the half sum.

When the upper limb is observed, add together the refraction less the parallax, the sun's semi-diameter, and the dip of the horizon. This correction is usually about 54 min., and is also subtracted from the sum of the latitude and polar distance, and added to the half sum.

The apparent time is found by the rule given on page 83 (Bowditch) for working the time by the tables, and the longitude by turning the difference between this time and the Greenwich date into degrees and minutes; unless great accuracy is required, the application of 22 minutes as a correction for the sun's lower limb, and 54 minutes for the upper, subtracted and added as above directed, will give an approximate result.

Example.

December 10th, 1889. Civil time, in latitude 42 degrees, 00 minutes north, and longitude 135 degrees, 00 minutes west, the sun's lower limb was observed to set 4 h. 30 m. P. M. Time by chronometer, 1 h. 30 m. 00 s.; error, 4 m. 00 s. fast; height of eye, thirty feet. Required the apparent time and longitude.

Refraction .....′ 33 ″ 00	App. time of obs.. H. M. S. 4 30 00	Hourly diff. declination ..″ 12.7
Sun's S. D..... 16 17	Long. 135° West, in time add.. 9 00 00	Greenwich hours and parts..... ..13.5
16 43	Greenwich date...13 30 00	635
Parallax 9	Declination..22° 59′ 26″ S.	381
16 34	Increas'g add cor. 2′ 51″	127
Dip [add]..... 5 23	Correct declin'n.. 23 02 17	60)171.45
Correction 21 57	90	Cor. of declination....2′ 51″.4
	Polar distance....113 02 17	
Sun's altitude....° 00 ′ 00		Hourly difference, equa'n 1.15
Latitude 42 00	secant.....0.12893	Gree'h hours and parts 13.5
Polar distance..113 02	co-secant.....0.03294	575
Sum 155 02		345
Corrections..... — 22		115
154 40		Correction 15.525
Half sum..... 77 20	co-sine 9.34099	M. S.
Correction [add] 22		Equation 6 43 9
77 42	sine.....9.98991	Decreasing, subtract... 15 5
H. M. S.	19.49277	Corrected equation....6 28 4
Time by chro..1 30 00	9.74638	=4h. 31m. 33s. apparent time.
Chro. fast, sub't 4 00		6 28 equa. subtract.
1 26 00		4 25 05
Add 12 00 00		
Gree'h mean time 13 26 00		
Time at ship.. 4 25 05		
Long. in time. 9 00 55	=135° 13′ 45″ west long.	

To Find the Latitude by the Polar Star.

During the year 1889, the mean declination of the Polar Star at its Upper Transit will be 88 degrees, 42 minutes north; at its Lower Transit, 91 degrees and 18 minutes; and at each Elongation 90 degrees.

In observations for latitude: After finding the altitude, subtract the proper correction for dip and refraction (generally 5 min.); then if the star is passing the Upper Transit, subtract the complement of the declination (that is, the difference between it and the 90 deg. = 1 deg. 18 min.), and the result is the latitude required.

If the star is passing its Lower Transit, add 1 deg. 18 min. with like result.

If the star is at either of its Elongations, no other corrections are to be applied than those for dip and refraction.

Example.

I.—On the 9th of July, 1889, at 6 h. 6 m. A. M., San Francisco time, the observed altitude of the Pole Star at the Upper Transit was 47 degrees, 47 min.; height of the observer 18 feet; required the latitude.

II.—On the 30th of May, 1889, at 8 h. 41 m P. M., the observed altitude of the Pole star at the Lower Transit was 54 deg. 20 min.; height of the observer 10 feet; required the latitude.

I.	M.	S.	II.	M.	S.
Observed altitude	47	42	Observed altitude	54	20
Subtract dip. 4 min., ref. 1 min.	5		Subtract dip. 4 min., ref. 1 min.	5	
True altitude	47	42	True altitude	54	15
Subtract comp. of dec.	1	18	Add comp. of dec	1	18
Latitude	46	24	Latitude	55	33

———o———

Mean Time of Transit of the Pole Star over the Meridian.

Also, the Eastern and Western Elongation for Every Tenth day in 1889. *Calculated for the Longitude of San Francisco.*

IN MEAN TIME.—10 minutes earlier than Standard time.

TRANSITS.						ELONGATIONS.					
1889.	Lower Transit. Morning.			1889.	Upper Transit. Morning.			1889.	Western Elongat'n. Morning.			1889.	Eastern Elongat'n Morning.		
	H.	M.	S.		H.	M.	S		H.	M.	S.		H.	M.	S.
Jan. 1	6	32	37	July 10	6	03	30	Jan. 1	0	33	36	July 10	0	02	31
Jan. 11	5	54	09	July 20	5	24	19		Evening.				Evening.		
Jan. 21	5	13	39	July 30	4	45	10	Jan. 11	11	51	12	July 20	11	21	22
Jan. 31	4	34	11	Aug. 9	4	06	01	Jan. 21	11	10	42	July 30	10	42	13
Feb. 10	3	54	42	Aug. 19	3	26	48	Jan. 31	10	31	14	Aug. 9	10	03	04
Feb. 20	3	15	16	Aug. 29	2	47	36	Feb. 10	9	51	45	Aug. 19	9	23	51
Mar. 2	2	35	49	Sep. 8	2	07	24	Feb. 20	9	12	18	Aug. 29	8	44	39
Mar. 12	1	56	24	Sep. 18	1	29	10	Mar. 2	8	32	52	Sep. 8	8	04	27
Mar. 22	1	17	01	Sep. 28	0	49	55	Mar. 12	7	53	27	Sep. 18	7	26	13
Apr. 1	0	37	40	Oct. 8	0	10	37	Mar. 22	7	14	04	Sep. 28	6	46	58
	Evening.				Evening.			Apr. 1	6	34	43	Oct. 8	6	07	40
Apr. 11	11	54	25	Oct. 18	11	27	24	Apr. 11	5	55	24		W. elong.		
Apr. 21	11	15	08	Oct. 28	10	48	05		E. elong.				Morning.		
May 1	10	35	53	Nov. 7	10	08	43		Morning.			Oct. 18	5	30	21
May 11	9	56	37	Nov. 17	9	29	20	Apr. 21	5	18	05	Oct. 28	4	51	02
May 21	9	17	24	Nov. 27	8	49	55	May 1	4	38	50	Nov. 7	4	11	40
May 31	8	38	13	Dec. 7	8	10	29	May 11	3	59	34	Nov. 17	3	32	17
June 10	7	59	02	Dec. 17	7	31	02	May 21	3	20	21	Nov. 27	2	52	52
June 20	7	19	52	Dec. 27	6	51	34	May 31	2	41	10	Dec. 7	2	13	26
June 30	6	40	43	Dec. 31	6	35	46	June 10	2	01	59	Dec. 17	1	33	59
								June 20	1	22	49	Dec. 27	0	54	31
								June 30	0	43	10	Dec. 31	0	38	43

The times for the intermediate days can be readily found by proportion.

Correction Table.

For Dip, Refraction, Semi-diameter and Parallax.

Quantities to be *added* to the observed altitude of the Sun's lower limb, when taken by a fore-observation, to find the true altitude.

The joint correction for dip, refraction, semi-diameter and parallax may be taken out and applied at once by means of this table.

The monthly correction at the foot of the table is to allow for the inequality of the Sun's semi-diameter, and can be applied where great accuracy is required.

For convenience, the table is given in Minutes and Tenths; these tenths of minutes can readily be turned into seconds by multiplying them by 6.

Obs. Alt.	Height of the Eye above the Sea, in Feet.												
	6	8	10	12	14	16	18	20	22	24	26	28	30
°	′	′	′	′	′	′	′	′	′	′	′	′	′
5	3.8	3.5	3.1	2.8	2.5	2.3	2.1	1.8	1.6	1.4	1.2	1.0	0.8
6	5.3	4.9	4.6	4.3	4.0	3.7	3.5	3.3	3.0	2.8	2.6	2.4	2.2
7	6.4	6.0	5.7	5.4	5.1	4.8	4.6	4.4	4.1	3.9	3.7	3.5	3.3
8	7.2	6.8	6.5	6.2	5.9	5.7	5.4	5.2	5.0	4.8	4.6	4.4	4.2
9	7.9	7.5	7.2	6.9	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.9
10	8.5	8.1	7.7	7.4	7.1	6.8	6.6	6.4	6.2	6.0	5.8	5.6	5.4
11	9.0	8.6	8.4	8.0	7.7	7.4	7.1	6.9	6.7	6.5	6.3	6.1	5.9
12	9.5	9.1	8.8	8.5	8.2	7.9	7.6	7.3	7.1	6.9	6.7	6.5	6.3
14	10.0	9.7	9.4	9.1	8.8	8.5	8.2	7.9	7.7	7.5	7.3	7.1	6.9
16	10.4	10.1	9.8	9.5	9.2	8.9	8.6	8.4	8.2	8.0	7.8	7.6	7.4
18	10.8	10.5	10.2	9.9	9.6	9.3	9.0	8.8	8.6	8.4	8.2	8.0	7.8
20	11.1	10.7	10.4	10.1	9.8	9.5	9.2	9.0	8.8	8.6	8.4	8.2	8.1
22	11.4	11.0	10.7	10.4	10.1	9.9	9.5	9.3	9.1	8.9	8.7	8.5	8.3
26	11.7	11.3	11.0	10.7	10.4	10.1	9.9	9.7	9.5	9.3	9.1	8.9	8.7
30	12.0	11.6	11.3	11.0	10.7	10.4	10.2	10.0	9.8	9.6	9.4	9.2	9.0
35	12.3	11.9	11.6	11.3	11.0	10.7	10.5	10.3	10.1	9.9	9.7	9.5	9.3
40	12.5	12.1	11.8	11.5	11.2	10.9	10.7	10.5	10.3	10.1	9.9	9.7	9.5
45	12.7	12.3	12.0	11.7	11.4	11.1	10.9	10.7	10.5	10.3	10.1	9.9	9.7
50	12.8	12.4	12.1	11.8	11.5	11.2	11.0	10.8	10.6	10.4	10.2	10.0	9.8
55	13.0	12.6	12.3	12.0	11.7	11.4	11.1	10.9	10.7	10.5	10.3	10.1	9.9
60	13.1	12.7	12.4	12.1	11.8	11.5	11.2	11.0	10.8	10.6	10.4	10.2	10.0
65	13.2	12.8	12.5	12.2	11.9	11.6	11.3	11.1	10 9	10.7	10.5	10.3	10.1
70	13.3	12.9	12.6	12.3	12.0	11.7	11.4	11.2	11.0	10.8	10.6	10.4	10.2
80	13.4	13.0	12.7	12.4	12.1	11.8	11.6	11.4	11.2	11.0	10.8	10.6	10.4
90	13.6	13.2	12.9	12.6	12.3	12.0	11.7	11.5	11.3	11.1	10.9	10.7	10.5

Month.	Jan.	Feb.	March	April	May	June
Correct'n.	+0.3	+0.2	+0.1	0 0	−0.1	−0.2

Month.	July	August	Sept.	October	Nov.	Dec.
Correct'n.	−0.3	−0.2	−0.1	+0.1	+0.2	+0.3

EXAMPLE.

TO ILLUSTRATE THE CORRECTION TABLE.

On the 1st of May, 1887, in longitude 137° 30′ W.; the meridian altitude of the Sun's lower limb, South of the observer, was found to be 69° 59′ the height of the eye above the sea being 18 feet, the index error 2′ 20″, to be subtracted. In what latitude is the observation made?

Sun's observed altitude	69°	59′	00″	S.
Index error		— 2	20	
	69	56	40	
Cor. for dip, refraction, &c		+ 11	24	
Sun's true altitude	70	08	04	S.
	90			
Sun's Mer. Zenith distance	19	51	56	N.
Decl. corrected for longitude	15	10	45	
Latitude	35	02	41	N.

RAINFALL AT SAN FRANCISCO, FROM 1849 to 1888.

FROM THE RECORDS OF THOMAS TENNENT.

	1849		1850		1851		1852		1853		1854		1855		1856	
	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days	Quantity.	Days.....
July	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	02	1
August	.....	..	.....	..	1 02	1	.....	..	04	1	01	1	.....	..	.....	..
Sept	.....	..	33	4	1 03	3	.....	..	46	5	15	4	.....	..	07	2
October	3 14	3	.....	..	21	2	80	2	12	2	2 41	10	.....	..	45	5
Nov.	8 66	8	92	7	2 12	8	5 31	4	2 28	12	34	2	67	8	2 79	8
Dec.	6 20	12	1 05	4	7 10	18	13 20	21	4 32	11	81	3	5 76	16	3 75	12
	1850		**1851**		**1852**		**1853**		**1854**		**1855**		**1856**		**1857**	
Jan	8 34	15	72	5	58	4	3 92	8	3 88	11	3 67	11	9 40	13	2 45	7
Feb	1 77	5	54	4	14	5	1 42	6	8 04	16	4 77	10	50	4	8 59	16
March	4 53	7	1 94	12	6 68	14	4 86	9	3 51	11	4 64	13	1 60	5	1 62	7
April	46	3	1 23	9	26	6	5 37	9	3 12	9	5 00	10	2 94	6	.....	..
May	.....	..	67	6	32	4	38	8	02	2	1 88	6	76	3	10	4
June	.....	..	.....	..	.....	..	.....	..	08	2	.....	..	03	1	12	1
	33 10	53	7 40	51	18 46	65	35 26	77	23 87	82	23 68	70	21 66	56	19 96	63

TABLE OF RAIN—Continued.

	1857		1858		1859		1860		1861		1862		1863		1864	
	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....
July.....	.....	..	05	2	.....	..	21	1	.....	..	.....	..	.....	..	.....	..
August.....	05	2	16	2	02	1	.....	..	.....	..	.....	..	.....	..	21	3
Sept.....	.....	..	.....	..	03	1	.....	..	02	1	.....	..	03	1	01	1
October.....	93	3	2 74	5	05	1	91	12	.....	..	40	4	.....	..	13	3
Nov.....	3 01	11	69	5	7 28	15	58	4	4 10	12	15	3	2 55	5	6 68	8
Dec.....	4 14	8	6 14	14	1 57	6	6 16	21	9 54	16	2 35	9	1 80	8	8 91	18
	1858		1859		1860		1861		1862		1863		1864		1865	
Jan.....	4 36	8	1 28	4	1 64	8	2 47	8	24 36	18	3 63	9	1 53	5	5 14	9
Feb.....	1 83	8	6 32	18	1 60	7	3 72	8	7 53	10	3 19	10	.....	..	1 34	8
March.....	5 55	8	3 02	11	3 99	13	4 08	8	2 20	11	2 06	8	1 52	9	74	4
April.....	1 55	4	27	4	3 14	8	51	4	73	9	1 61	9	1 57	4	94	3
May.....	34	3	1 55	4	2 86	12	1 00	3	74	5	23	2	78	5	63	2
June.....	05	1	.....	..	09	2	08	2	05	1	.....	..	.....	..	.....	..
	21 81	56	22 22	69	22 27	74	19 72	71	49 27	83	13 62	54	10 08	37	24 73	59

TABLE OF RAIN—Continued.

	1865		1866		1867		1868		1869		1870		1871		1872	
	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....
July.....	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..
August.....	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..
Sept.....	24	2	11	2	04	1	.....	..	12	1	03	1	03	2	14	1
October.....	26	4	.....	..	20	1	15	3	1 29	4	.....	..	11	2	21	1
Nov.....	4 19	10	3 35	12	3 41	6	1 18	5	1 19	7	43	6	3 72	9	2 62	4
Dec.....	58	8	15 16	18	10 69	18	4 34	12	4 31	8	3 38	8	16 74	14	7 25	10
	1866		1867		1868		1869		1870		1871		1872		1873	
January.....	10 88	16	5 16	15	9 50	17	6 35	15	3 89	10	3 07	7	4 22	10	2 17	8
Feb.....	2 12	9	7 20	9	6 13	10	3 90	7	4 78	11	3 76	10	6 97	20	4 24	17
March.....	3 04	12	1 58	7	6 30	12	3 14	12	2 00	8	1 29	7	1 64	10	78	4
April.....	12	1	2 36	8	2 31	9	2 19	5	1 53	6	1 93	4	1 10	7	52	3
May.....	1 46	6	.....	..	03	2	08	2	20	2	21	3	16	3	01	1
June.....	04	1	.....	..	23	3	02	1	.....	..	.....	..	02	2	08	1
	22 93	69	34 92	71	38 84	79	21 35	62	19 31	57	14 10	46	34 71	79	18 02	51

Rain-Gauges of the most Approved Styles, Made and for Sale by Thomas Tennent, No. 18 Market St.

TABLE OF RAIN—Continued.

	1873		1874		1875		1876		1877		1878		1879		1880	
	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....
July	03	2	.....	..	.....	..	01	1	.....	..	01	1	02	1	.....	..
August	15	3	.....	..	.....	..	02	2	.....	..	01	1	.....	..	.....	..
Sept	.....	..	08	2	.....	..	26	3	.....	..	62	4	02	1	.....	..
October	68	2	2 73	8	22	2	2 69	7	58	4	1 19	2	63	2	02	1
Nov.	1 31	6	5 92	7	6 73	15	23	3	1 38	8	52	3	2 25	8	41	1
Dec.	10 12	20	28	4	3 08	10	.....	..	2 37	7	62	5	6 31	12	11 43	20
	1874		**1875**		**1876**		**1877**		**1878**		**1879**		**1880**		**1881**	
January	4 85	14	6 97	11	6 41	14	4 36	9	10 69	16	4 23	13	2 27	7	8 11	9
Feb.	1 83	10	20	1	3 96	7	1 14	7	10 75	13	4 67	11	1 96	8	4 32	14
March	3 55	15	1 08	6	4 37	11	91	7	4 26	13	8 26	12	1 82	9	45	4
April	1 04	7	02	1	1 04	8	25	6	96	4	2 29	10	10 02	17	1 83	7
May	34	4	11	2	18	1	13	1	12	2	2 13	5	1 08	4	18	2
June	08	2	1 01	3	02	1	.....	..	01	1	01	1	.....	..	76	3
	23 98	85	18 40	45	26 01	69	10 00	46	31 12	68	24 56	68	26 38	69	27 51	61

TABLE OF RAIN—Continued.

	1881		1882		1883		1884		1885		1886		1887	
	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....	Quantity.	Days.....
July	.....	..	.....	..	.....	..	.....	..	06	2	26	1	.....	..
August	.....	..	.....	..	.....	..	03	1	.....	..	.....	..	.....	..
September	23	3	24	1	45	2	31	2	12	2	01	1	0 29	5
October	48	5	2 62	8	1 45	6	2 51	4	72	3	1 54	6	.....	..
November	1 86	5	4 14	9	1 55	3	28	3	11 60	18	61	4	99	5
December	3 90	12	2 07	7	87	8	7 44	12	5 03	8	2 05	7	3 34	9
	1882		**1883**		**1884**		**1885**		**1886**		**1887**		**1888**	
January	1 40	9	1 97	5	3 94	10	2 42	10	7 32	12	1 93	7	6 80	16
February	2 83	9	1 10	4	6 53	14	32	4	27	4	9 18	16	94	4
March	3 45	11	2 83	7	8 16	16	96	6	2 01	11	84	3	3 60	4
April	1 20	9	1 39	5	6 15	12	3 20	12	5 24	10	2 27	9	11	1
May	22	4	3 47	8	22	3	06	1	35	3	05	3	37	3
June	05	2	.....	..	2 44	7	21	2	01	1	03	1	12	3
	15 62	68	19 83	54	31 76	81	17 74	57	32 73	74	18 77	58	16 57	50

Average Rain-Fall from the Season of 1849–50 to that of 1887–88—39 Seasons, 23.5 inches.

Table of Wages per Day, from $5 00 a Month to $100.00 a Month.

Dy	$5	$10	$15	$20	$25	$30	$35	$40	$45	$50	$55	$60	$65	$70	$75	$80	$85	$90	$95	$100	Dy
1	17	33	50	67	83	1 00	1 17	1 33	1 50	1 67	1 83	2 00	2 17	2 33	2 50	2 67	2 83	3 00	3 17	3 33	1
2	33	67	1 00	1 33	1 67	2 00	2 33	2 67	3 00	3 33	3 67	4 00	4 33	4 67	5 00	5 33	5 67	6 00	6 33	6 67	2
3	50	1 00	1 50	2 00	2 50	3 00	3 50	4 00	4 50	5 00	5 50	6 00	6 50	7 00	7 50	8 00	8 50	9 00	9 50	10 00	3
4	67	1 33	2 00	2 67	3 33	4 00	4 67	5 33	6 00	6 67	7 33	8 00	8 67	9 33	10 00	10 67	11 33	12 00	12 67	13 33	4
5	83	1 67	2 50	3 33	4 17	5 00	5 83	6 67	7 50	8 33	9 17	10 00	10 83	11 67	12 50	13 33	14 17	15 00	15 83	16 67	5
6	1 00	2 00	3 00	4 00	5 00	6 00	7 00	8 00	9 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	6
7	1 17	2 33	3 50	4 67	5 83	7 00	8 17	9 33	10 50	11 67	12 83	14 00	15 17	16 33	17 50	18 67	19 83	21 00	22 17	23 33	7
8	1 33	2 67	4 00	5 33	6 67	8 00	9 33	10 67	12 00	13 33	14 67	16 00	17 33	18 67	20 00	21 33	22 67	24 00	25 33	26 67	8
9	1 50	3 00	4 50	6 00	7 50	9 00	10 50	12 00	13 50	15 00	16 50	18 00	19 50	21 00	22 50	24 00	25 50	27 00	28 50	30 00	9
10	1 67	3 33	5 00	6 67	8 33	10 00	11 67	13 33	15 00	16 67	18 33	20 00	21 67	23 33	25 00	26 67	28 33	30 00	31 67	33 33	10
11	1 83	3 67	5 50	7 33	9 17	11 00	12 83	14 67	16 50	18 33	20 17	22 00	23 83	25 67	27 50	29 33	31 17	33 00	34 83	36 67	11
12	2 00	4 00	6 00	8 00	10 00	12 00	14 00	16 00	18 00	20 00	22 00	24 00	26 00	28 00	30 00	32 00	34 00	36 00	38 00	40 00	12
13	2 17	4 33	6 50	8 67	10 83	13 00	15 17	17 33	19 50	21 67	23 83	26 00	28 17	30 33	32 50	34 67	36 83	39 00	41 17	43 33	13
14	2 33	4 67	7 00	9 33	11 67	14 00	16 33	18 67	21 00	23 33	25 67	28 00	30 33	32 67	35 00	37 33	39 67	42 00	44 33	46 67	14
15	2 50	5 00	7 50	10 00	12 50	15 00	17 50	20 00	22 50	25 00	27 50	30 00	32 50	35 00	37 50	40 00	42 50	45 00	47 50	50 00	15
16	2 67	5 33	8 00	10 67	13 33	16 00	18 67	21 33	24 00	26 67	29 33	32 00	34 67	37 33	40 00	42 67	45 33	48 00	50 67	53 33	16
17	2 83	5 67	8 50	11 33	14 17	17 00	19 83	22 67	25 50	28 33	31 17	34 00	36 83	39 67	42 50	45 33	48 17	51 00	53 83	56 67	17
18	3 00	6 00	9 00	12 00	15 00	18 00	21 00	24 00	27 00	30 00	33 00	36 00	39 00	42 00	45 00	48 00	51 00	54 00	57 00	60 00	18
19	3 17	6 33	9 50	12 67	15 83	19 00	22 17	25 33	28 50	31 67	34 83	38 00	41 17	44 33	47 50	50 67	53 83	57 00	60 17	63 33	19
20	3 33	6 67	10 00	13 33	16 67	20 00	23 33	26 67	30 00	33 33	36 67	40 00	43 33	46 67	50 00	53 33	56 67	60 00	63 33	66 67	20
21	3 50	7 00	10 50	14 00	17 50	21 00	24 50	28 00	31 50	35 00	38 50	42 00	45 50	49 00	52 50	56 00	59 50	63 00	66 50	70 00	21
22	3 67	7 33	11 00	14 67	18 33	22 00	25 67	29 33	33 00	36 67	40 33	44 00	47 67	51 33	55 00	58 67	62 33	66 00	69 67	73 33	22
23	3 83	7 67	11 50	15 33	19 17	23 00	26 83	30 67	34 50	38 33	42 17	46 00	49 83	53 67	57 50	61 33	65 17	69 00	72 83	76 67	23
24	4 00	8 00	12 00	16 00	20 00	24 00	28 00	32 00	36 00	40 00	44 00	48 00	52 00	56 00	60 00	64 00	68 00	72 00	76 00	80 00	24
25	4 17	8 33	12 50	16 67	20 83	25 00	29 17	33 33	37 50	41 67	45 83	50 00	54 17	58 33	62 50	66 67	70 83	75 00	79 17	83 33	25
26	4 33	8 67	13 00	17 33	21 67	26 00	30 33	34 67	39 00	43 33	47 67	52 00	56 33	60 67	65 00	69 33	73 67	78 00	82 33	86 67	26
27	4 50	9 00	13 50	18 00	22 50	27 00	31 50	36 00	40 50	45 00	49 50	54 00	58 50	63 00	67 50	72 00	76 50	81 00	85 50	90 00	27
28	4 67	9 33	14 00	18 67	23 33	28 00	32 67	37 33	42 00	46 67	51 33	56 00	60 67	65 33	70 00	74 67	79 33	84 00	88 67	93 33	28
29	4 83	9 67	14 50	19 33	24 17	29 00	33 83	38 67	43 50	48 33	53 17	58 00	62 83	67 67	72 50	77 33	82 17	87 00	91 83	96 67	29
30	5 00	10 00	15 00	20 00	25 00	30 00	35 00	40 00	45 00	50 00	55 00	60 00	65 00	70 00	75 00	80 00	85 00	90 00	95 00	100 00	30

BURIAL SERVICE AT SEA.

Dear Brethren and Friends: From the beginning, even until now, the mournful decree has gone forth into all the earth, Dust thou art, and unto dust shalt thou return. One generation passeth away, and another generation cometh; and there are few who can hide themselves from the solemn thought, I too must die, and the places which know me shall know me no more.

Blessed be the Lord, who healeth the broken-hearted and bindeth up their griefs. Even before the Day-Star appeared, beauty sprang up out of ashes, and bloomed in the midst of all emblems of a perishing life. Desire for a better country, even a heavenly, was answered by a voice from the Invisible Presence; believing souls hearkened with reverence, and all wailing was subdued into a psalm of trust.

LET US PRAY.

Merciful Father: Help us rightly to improve the lesson of this solemn occasion. May we be the wiser and the better for our coming to this scene of mourning and of prayer. May we henceforth learn to live more truly, and diligently to do our work while the day lasts.

And when Thou shalt call us away, may we be ready to go with a calm and trustful spirit, lifting up the song of triumph, O death, where is thy sting? O grave, where is thy victory? Thanks be to GOD, who giveth us the victory, through our Lord Jesus Christ.

As for man, his days are as grass; as a flower of the field, so he flourisheth. For the wind passeth over it—and it is gone,—and the place thereof shall know it no more. The Lord gave, and the Lord hath taken away: Blessed be the name of the Lord.

My days are like a shadow that declineth, and I am withered like grass; but Thou, O Lord, shall endure forever, and Thy remembrance unto all generations. Man, that is born of a woman, is of few days and full of misery. He cometh forth like a flower, and is cut down; he fleeth also as a shadow, and continueth not. In the midst of life we are in death. Of whom may we seek for succor, but of Thee, O LORD?

Forasmuch as the spirit, created in the image of GOD, hath returned unto Him who gave it, we therefore commit the body to the deep, (here the body is cast into the sea) believing in that change from the earthly to the heavenly, which is the resurrection of the life to come, even deliverance from the bondage of corruption into the glorious liberty of the children of GOD.

LORD most merciful, prepare us for the upward journey, and bring us at last into that higher life, in which darkness and death shall be unknown, and sorrow and sighing shall flee away. AMEN.

NOTICE TO MARINERS.

—THE—

WESTERN UNION TELEGRAPH CO.

—THE—

SUNSET TELEPHONE-TELEGRAPH CO.

AND THE

PACIFIC POSTAL TELEGRAPH-CABLE CO.

Direct the special attention of masters and officers of vessels to their Submarine Telegraph Cables, which are located as follows:

WESTERN UNION TELEGRAPH CO.

Two cables from Market Street wharf to the long wharf or pier on the Oakland side, nearly as possible in the 1,000 feet reserved by law for the protection of ferry boats, indicated by large signs: **"Telegraph Cable Crossing."**

A cable, commencing at the Government wharf, near Fort Point, running northerly 5,000 feet, thence north-westerly to the embankment joining Needle Rock and the mainland; indicated by signs.

A cable laid from the northerly pier of the Southern Pacific Railroad Co., on the Benicia side, to a small ravine or cove on the Contra Costa shore, both landings indicated by large signs: **"Telegraph Cable Crosses Here."**

SUNSET TELEPHONE-TELEGRAPH CO.

A cable is laid from Market Street wharf to the south-west shore of Goat Island, and from the easterly shore of Goat Island to the railway shipping pier on the Oakland side; indicated by large signs.

A cable from the coal bunkers of the Railway Co. at Port Costa to the northerly pier of the Railway Co. on the Benicia side; both landings indicated by large signs.

A cable across the Straits of Carquinez, from the northerly end of the Grangers' wharf (about one mile below Port Costa) to a point directly opposite on the Benicia shore; both landings indicated by large signs: **"Telegraph Cable Crossing."**

PACIFIC POSTAL TELEGRAPH-CABLE CO.

A cable from the narrow gauge ferry slip, situated between Mission and Market Streets, to the westerly end of the south shipping pier of the Railway Co. on the Oakland side; indicated by a large white sign bearing the words: **"Pacific Postal-Telegraph Cable Crossing."**

A cable from the westerly end of the Nevada dock warehouse (about half a mile east of Port Costa) to the Martinez and Benicia ferry landing on the Benicia side; indicated by the sign: **"Pacific Postal Telegraph-Cable Crossing."**

REMARKS.

Signs are erected at the landing points of all these cables as required by law, and persons or vessels breaking or damaging the cables, whether by dragging anchors or otherwise, are liable to a fine of not less than $500 nor more than $10,000, in addition to full damages arising from injury done to the cable. The Sunset Company has obtained judgments against three different ships, viz: "*Charmer*," "*Blue Jacket*," and "*Enoch Talbot*," in sums of from $1,500 to $2,200 each, for damages to its cables.

FRANK JAYNES,
Supt. Western Union Tel. Co.

GEO. S. LADD,
Pres't Sunset Tel.-Tel. Co.

L. W. STORROR,
Ass't Sup't Pacific Postal-Tel. Co.

SAN FRANCISCO, December, 1883.

FIRE. MARINE.

SUN INSURANCE COMPANY,

428 CALIFORNIA STREET, SAN FRANCISCO.

CAPITAL PAID UP.....$300,000
SURPLUS TO POLICY HOLDERS.....$500,000

OFFICERS.

C. L. TAYLOR.....President
J. N. KNOWLES.....Vice-President
ED. E. POTTER.....Secretary and Treasurer

DIRECTORS.

J. Steinhart, R. D. Chandler, Geo. H. Collins,
J. B. Stetson, J. J. McKinnon, J. B. Moffo,
E. B. Pond, Alfred Barstow, C. L. Dingley,
C. L. Taylor, J. N. Knowles.

A feature peculiar to this Company is, that under its By-Laws from twenty-five to fifty per cent. of its profits must be laid aside as a reserve fund for the better protection of its policy-holders.

☞In the event of a total loss on a building, if the present cost is less than the insurance, the premium for the current year on the difference will be refunded; the only Policy on the Pacific Coast that contains this clause.

TARR & WONSON'S

Patent Copper Paint.

TO OWNERS OF VESSELS, SHIP MASTERS AND THE TRADE.

We call your attention to the great superiority of this Paint for Wooden Bottomed Vessels over all others ever introduced in this market.

Its highly favorable reputation in California during the past twenty-five years, and the fact that NO other paint could successfully compete with it in quality, are sufficient guarantees of its excellence and durability.

WE ARE AUTHORIZED BY THE MANUFACTURERS

TO GUARANTEE IT TO LAST CLEAN FOR TWELVE MONTHS,

If properly applied according to directions.

PRICE OF THE PAINT LATELY REDUCED TWENTY PER CENT.

Any parties adulterating this Paint will be promptly prosecuted.

C. L. TAYLOR & CO.

No. 34 CALIFORNIA ST., Agents for the Pacific Coast.

COMMERCIAL
INSURANCE CO. OF CALIFORNIA.

FIRE and MARINE.

This Company aims to secure the Best Risks on all desirable hazards, at Remunerative Rates. Prompt and Equitable Adjustment and Payment of Losses.

Capital Paid in Full - - - $200,000.00
Assets, December 31st, 1887 - - 434,194.75
Losses paid since organization - over 2,000,000

JOHN H. WISE, *President.* CHAS. A. LATON, *Secretary.*

Principal Office, No. 439 California Street, San Francisco.
SAFE DEPOSIT BUILDING.
CAPT. A. Y. TRASK, Marine Surveyor.

MILTON ANDROS,

COUNSELOR-AT-LAW

—AND—

PROCTOR IN ADMIRALTY,

224 SANSOME ST., S. E. cor. CALIFORNIA

SAN FRANCISCO.

STEWART MENZIES. ARTHUR McCRAKEN. HENRY BINGHAM.

MENZIES, BINGHAM & CO.

STEVEDORES.

Office, OLD MERCHANTS' EXCHANGE,

Nos. 512 & 514 BATTERY STREET,

Opposite Custom House, San Francisco.

JAMES B. CHASE & CO.

STEVEDORES

—AND—

BALLASTMEN,

No. 17 STEUART STREET, SAN FRANCISCO, CAL.

TELEPHONE 1315.

Cargoes Discharged or Ships Ballasted with Promptness and Dispatch.

H. C. PITMAN. J. G. LEVENSALER.

PITMAN & LEVENSALER,

STEVEDORES

OFFICE,

No. 42 MARKET STREET,

San Francisco.

THEODORE H. ALLEN. THOMAS YOUNG.

ALLEN & YOUNG,

PIONEER

STEVEDORES,

SAN FRANCISCO.

Office, 1026 Battery Street.

BOX 1250.

CHAS. E. HASELTINE & CO.

STEVEDORES

—AND—

BALLASTMEN

No. 36 STEUART STREET, Up Statrs,

San Francisco, Cal.

Vessels Discharged, Ballasted, Loaded Carefully and with Dispatch.

WARREN F. MILLS. ALBERT H. HERRIMAN.

HERRIMAN & MILLS,

STEVEDORES,

Office, 22 CALIFORNIA STREET,

SAN FRANCISCO.

THOS. REYNOLDS,

SAIL MAKER,

S. E. CORNER MARKET and STEUART STS.

SAN FRANCISCO.

CAPT. W. H. FERGUSON. CAPT. E. P. TAYLOR.

SCHOOL OF NAVIGATION,

No. 5 MARKET STREET, ROOM 7.

PRACTICAL NAVIGATION THOROUGHLY TAUGHT

Candidates prepared for examination by the Marine Board and Local Inspectors of Steamships.

DAY AND EVENING,

10 to 12 A. M.——1 to 4 P. M.——7 to 9 P.M.

TERMS, $60. SINGLE LESSONS, $2.50.

CAPT. W. H. FERGUSON,.....Instructor.

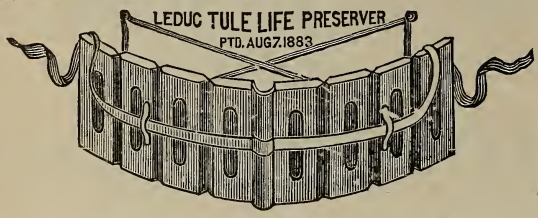
Successor to Capt. B. B. Sharp.

CHAS. J. HENDRY, President. C. P. HOWES, Vice-President. ISAAC MOORE, Secretary.

The Leduc Tule Improvement Co.

Sole Manufacturers of the Leduc Tule Life Preserver and Tule Life Raft,

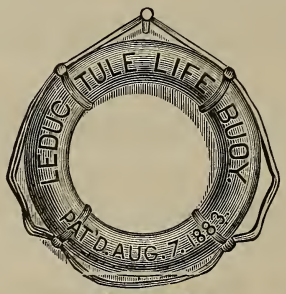
2, 4 and 6 MARKET STREET, SAN FRANCISCO, CAL.



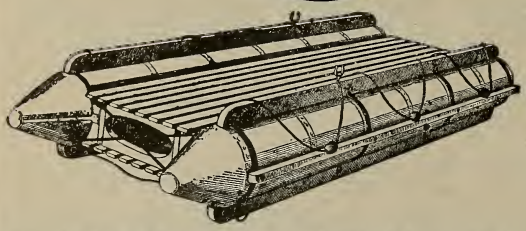
Fifty per cent. more buoyancy than any other Life Preserver. It is imperishable, and gains buoyancy with age, while cork loses it. Buoyancy required by Government guaranteed for five years.

UNEQUALLED IN BUOYANCY, DURABILITY, LIGHTNESS AND CHEAPNESS.

TULE RING BUOY.



THE LIGHTEST BUOY EVER MANUFACTURED.



TULE LIFE RAFT

Adopted and approved by U.S. Inspection Service. Rafts from four to thirty feet.

The best Life-saving Devices in the World, and the only Raft that can be Penetrated and Retain its Buoyancy.

Agencies established where Tule Preservers can be had in Lots to suit

James Baker, Boston, Mass.; George B. Carpenter & Co., Chicago, Ill.; H. D. Edwards & Co., Detroit, Mich.; Consolidated Boat Store Co., Cincinnati, Ohio; Arnold Bros., Pittsburg, Pa.; Sutton & Beebe, Portland, Or.; Manion & Co., St Louis, Mo.; Swanton & Jameson, Bath, Me.; Loud, Claridge & Co., Baltimore, Md; Woodward, Wight & Co., New Orleans, La.; Darrah & Elwell, Philadelphia, Pa.; W. L. Blake & Co., Portland, Me.; H. H. Baker & Co., Buffalo, N. Y.; DeGrauw, Aymar & Co., 35 South Street, New York City; Geo. E Chase, Jacksonville, Fla.; Joy, Norris & Co., Milwaukee; W. S. Cherry & Co., Savannah, Ga.; W. W. Hite & Co., Louisville, Ky.; R. B Wing & Sons, Albany, N. Y.; H. Marwitz & Co, Galveston, Texas; Nealey & Co., Bangor, Me.; Upson, Walson & Co., Cleveland, O.; Daniel Lyons & Sons, Oswego, N. Y.; Walter Coleman & Sons, Providence, R I.

CHAS. J. HENDRY,

Importer of and Dealer in Ship Chandlery and Naval Supplies,

2, 4, 6 and 8 Market Street; 1, 3, 5 and 7 Sacramento Street, SAN FRANCISCO.

W. W. MONTAGUE & CO.

STOVES,

RANGES AND

CABOOSES

FOR SHIPS' USE.

MANUFACTURERS OF

Sheet Iron Stoves

—AND—

Mississippi Ranges.

TIN, COPPER & SHEET IRON WARE,

PUMPS,

IRON PIPE AND FITTINGS

For Steam and Water.

Nos. 309, 311, 313, 315, 317

MARKET STREET,

Between Beale and Fremont, San Francisco.

S. FOSTER & CO.

Importing and Jobbing

GROCERS

And Agents for

Top-o-Can Brand Diamond Creamery Butter,

In hermetically sealed tins,

WARRANTED TO KEEP IN HOT CLIMATES.

The Best Article packed for Ship-stores and Foreign Trade.

26 and 28 CALIFORNIA ST., SAN FRANCISCO, CAL.

THE

SATHER BANKING COMPANY,

CAPITAL, $1,250,000.

SUCCESSOR TO SATHER & CO. ESTABLISHED 1851,

SAN FRANCISCO.

OFFICERS:		DIRECTORS:	
HENRY L. DODGE,	President.	HENRY L. DODGE,	CHARLES MAIN,
J. L. N. SHEPARD,	Vice-President.	ALBERT MILLER,	LOUIS SLOSS,
J. S. HUTCHINSON,	Manager.	F. W. SUMNER,	J. L. N. SHEPARD,
		W. P. JOHNSON.	

Sell Bills and Telegraphic Exchange on

DREXEL, MORGAN & CO. *New York.* **DREXEL & CO.** *Philadelphia.* **DOWNER & CO.** *Boston.*

MAKE COLLECTIONS IN ALL PARTS OF THE UNITED STATES.

Issue Letters of Credit on

Messrs. BROWN, SHIPLEY & CO. *London.* **Messrs. DREXEL, HARJES & CO.** *Paris.*

Which are Exchangeable for Travelers' Credits, available in all parts of the World.

Also, Draw Exchange on

LONDON, PARIS, HAMBURG, COLOGNE, BERLIN, BREMEN, CASSEL, FRANKFORT-ON-MAIN, LEIPSIC, STUTTGART, BASLE.